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Assessment of causes of childhood obesity in 11 year-old Maltese children

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LITERATURE REVIEW

ABSTRACT

Childhood obesity has seen a dramatic increase worldwide over the past three decades and its health consequences have become an international financial burden. Local Maltese studies have shown that childhood obesity is equally prevalent. Co-morbidities such as type 2 diabetes and hypertension are now more frequently seen in younger obese patients.

Some common factors which contribute to childhood obesity result in excessive calorie consumption, such as sugar-sweetened beverage consumption, while others decrease energy utilisation, e.g. lack of moderate to vigorous physical activity (less than 75 minutes per school day) and prolonged screen-time over the recommended 2 hours per day. However, other factors which are not directly related to energy intake or output, such as lack of sleep hygiene, are increasingly being shown to contribute to childhood obesity.

In order to combat childhood obesity, researchers must endeavour to identify the factors, both on an individual and an environmental basis, which are contributing to the increase in its occurrence.

Maltese studies are necessary to identify the major contributing factors of childhood obesity and to find interventions that are effective locally.

1. INTRODUCTION

Childhood obesity has increased alarmingly in the last 30 years – in the USA by 400% in 6 – 11 year-olds (Ogden et al., 2010; Ogden et al., 2006; Ogden, Carroll, & Flegal, 2008; Spear et al., 2007), totalling 12.7 million or 20% children in this age group (Black, Menzel, & Bungum, 2015; CDC, 2013). Obesity-related conditions are a financial burden (Wolf & Colditz, 1998), costing $14.1 billion/year (Borger et al., 2006; Smith, Cowan, Heffler, Catlin, & National Health Accounts, 2006; Trasande & Chatterjee, 2009) .

In the UK, 19% of boys and 16% of girls aged 2 – 15 were obese in 2014 (HSCIC, 2014; NOO, 2014; Reilly & Dorosty, 1999) while another 13% were overweight (HSCIC, 2015); this prevalence of childhood obesity is on the rise in the UK especially in schoolchildren (Stamatakis, Wardle, & Cole, 2010) and is leading to severe financial consequences according to the UK's 2007 Foresight Report (Lobstein et al., 2015). In 2012, nearly half of Maltese 11 – 12 year-olds were either overweight or obese (Decelis, Jago, & Fox, 2014a), making it the greatest national health crisis at present (Grech, 2006) and ranking Malta as one of the countries with the highest levels of childhood obesity (Janssen et al., 2005). This trend is also reflected both in Europe (Wang & Lobstein, 2006) and globally with a 47% rise in children with a body mass index (BMI) >25 since 1980 (Ng et al., 2014; Wang & Lobstein, 2006; Yang et al., 2008), with 42 million children under 5 years being obese or overweight in 2013 (WHO, 2013). Hence, in the developed world, obesity is the commonest nutrition-related childhood disease (Etelson, Brand, Patrick, & Shirali, 2003).

Age, socio-economic class and race are all risk factors for childhood obesity (Anderson & Whitaker, 2009; Centers for Disease Control, 2009; Delva, Johnston, & O'Malley, 2007; Freedman et al., 2007; Gordon-Larsen, Adair, & Popkin, 2003; Miech et al., 2006; Ogden *et*

al., 2006; Ogden, Yanovski, Carroll, & Flegal, 2007; Wang & Zhang, 2006). In some countries, the incidence of childhood obesity seems to be plateauing in higher socioeconomic groups (22nd European Congress on Obesity (ECO2015), 2015; Ogden et al., 2010) although severe obesity is on the rise (Koebnick et al., 2010; Skelton, Cook, Auinger, Klein, & Barlow, 2009).

An increasing prevalence in co-morbidities (Flegal, Carroll, Ogden, & Curtin, 2010; Ng et al., 2014), such as type 2 diabetes (T2DM) (American Diabetes Association, 2008; Baranowski et al., 2006; Duncan, 2006; Fagot-Campagna, Saaddine, Flegal, & Beckles, 2001; Goran, Ball, & Cruz, 2003; Liu et al., 2005; Mokdad et al., 2000; Ogden et al., 2007; Pinhas-Hamiel & Zeitler, 2005), hypertension (Din-Dzietham, Liu, Bielo, & Shamsa, 2007; Falkner et al., 2006; Jago et al., 2006), cardiovascular problems (Etelson et al., 2003; Falkner, DeLoach, Keith, & Gidding, 2013; Freedman, Dietz, Srinivasan, & Berenson, 1999; Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001; Lobstein et al., 2015; Thompson et al., 2007; Urbina, Gidding, Bao, Elkasabany, & Berenson, 1999; Williams et al., 2005), dyslipidaemia (Jago et al., 2006), metabolic syndrome (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003; Duncan, Li, & Zhou, 2004; Grundy et al., 2002; Jolliffe & Janssen, 2007; Weiss et al., 2004), bone/joint problems, respiratory (Gupta, Mueller, Chan, & Meininger, 2002; Rodriguez, Winkleby, Ahn, Sundquist, & Kraemer, 2002; Schachter, Peat, & Salome, 2003) and orthopaedic problems (Karlson et al., 2003; Yanovski, 2001), polycystic ovary syndrome (Baillargeon & Nestler, 2006; Sharma & Nestler, 2006) and social/psychological problems (Anderson, Cohen, Naumova, Jacques, & Must, 2007; Eisenberg, Neumark-Sztainer, & Story, 2003; Ludwig, 2007), is paralleled with rising incidence of childhood obesity (Hazreen et al., 2014; Ogden et al., 2008; Orio *et al.*, 2014). However large randomised trials on obese children are lacking (Ng et al., 2014).

Hence obesity in children leads to decreased quality-of-life especially in severe childhood obesity (Kushner & Foster, 2000; Schwimmer, Burwinkle, & Varni, 2003; Tyler, Johnston, Fullerton, & Foreyt, 2007). Indeed, the repercussions of childhood obesity lead to early death (Barlow, 2007; Narayan, Boyle, Thompson, Sorensen, & Williamson, 2003) and long-term morbidity and mortality (Franks et al., 2010; Power, Lake, & Cole, 1997) which continue into adulthood (Belsky et al., 2012; Horta, Gigante, Lima, Barros, & Victora, 2013; Laessle, Uhl, Lindel, & Muller, 2001; Lawrence et al., 2014; Rillamas-Sun, Sowers, Harlow, & Randolph, 2012; Stettler, Kumanyika, Katz, Zemel, & Stallings, 2003; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997) and high BMI alone predicts premature mortality (Franks et al., 2010; Olshansky et al., 2005; van Dam, Willett, Manson, & Hu, 2006).

Hence it is important to investigate the factors leading to childhood obesity in an effort to combat this condition early in life (Neumark-Sztainer, 2005). These factors may not only focus on the obese individual but also on the surrounding environment (Sallis, Floyd, Rodriguez, & Saelens, 2012).

2. SOME COMMON FACTORS AFFECTING CHILDHOOD OBESITY

Childhood obesity results from excessive calorie consumption when compared with those utilized (Hill, Wyatt, & Peters, 2012). However, childhood obesity is not simple but is a rather complex and multifaceted condition, resulting from the interaction of several factors (genetic, parental, pre- and post-natal, behavioural and environmental amongst others) (CDC, 2015; Frayling et al., 2007; Karnik & Kanekar, 2012; Perusse & Bouchard, 1999; Vos & Welsh, 2010). Excessive sugar intake, larger portion sizes and decreased physical activity are amongst some of the major culprits for the rising prevalence of obesity in children worldwide (Sahoo et al., 2015). Some factors, such as diet and food preferences, have been shown to have a greater influence than others (like physical inactivity and BMI) on childhood obesity (Murray & Atkinson, 2013; Pingali, 2007).

The following discussion focuses on four main areas that have been shown to possibly affect childhood obesity (Sahoo et al., 2015): physical activity, screen-time, soft-drinks or sweetened beverage consumption and sleep hygiene.

2.1 Physical activity

Physical activity is an important and controllable component of energy expenditure (Westerterp, 2013) although studies have given mixed results (Reilly et al., 2006); however, some studies consider physical activity on its own and not in relation to other factors such as diet and this probably influences the outcome of these studies negatively. Increasing prevalence of overweight and obesity in children (Ogden, Carroll, Kit, & Flegal, 2014) has paralleled the rise in physical inactivity (Committee on Physical Activity and Physical Education in the School, & Institute of Food and Nutrition, 2013) even at a very young age (Black et al., 2015; Singh, Siahpush, & Kogan, 2010; Tandon, Saelens, & Christakis, 2015). In

fact, children who are obese have been found to spend less time in moderate-to-vigorous physical activity (MVPA) than their lean peers (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Trost, Kerr, Ward, & Pate, 2001). The risk of childhood obesity decreases by 10% for every hour spent daily on MVPA (Hernandez et al. , 1999). Physical inactivity must be distinguished from sedentary behaviours as they are each considered as independent risk factors to an individual's health (Saliba, 2015). A sharp decline in physical activity as children enter their teenage years has also been noted in certain studies (Haverly & Davison, 2005).

Physical activity has been shown to affect children in their physical as well as mental development (Goran & Treuth, 2001). Moderate to vigorous activity for at least 75 minutes on every school day has been shown to give overall health benefits even to preschool children (Lobstein, Baur, & Uauy, 2004; Tandon et al., 2015), such as decreasing body fat percentage and improving bone mineralisation and BMI (Black et al., 2015; Dwyer, Coonan, Leitch, Hetzel, & Baghurst, 1983; Gutin & Owens, 1999; Yin et al., 2005; Yin, Hanes et al., 2005; Yin, Moore et al., 2005). Indeed, increased physical activity has been shown to be related to a decline in BMI in girls (Berkey et al., 2000) while low aerobic fitness is a predictor of elevated adiposity in children (Johnson et al., 2000); children with low fitness levels had more than a three-fold risk of being overweight/obese and were more likely to gain weight disproportionately when compared to their fitter peers (McGavock, Torrance, McGuire, Wozny, & Lewanczuk, 2009) . Moreover, physically active children have been shown to continue this healthy habit even in their adult years thus continuing to provide the benefits offered at a young age (Telama et al., 2005). Current recommendations are that children aged 5 – 18 years should engage in moderate-to-vigorous physical activity (MVPA) for a minimum of 60 minutes a day up to several hours daily (UK Department of Health, 2011). In the UK, more boys (21%) than girls (16%) aged between 5 and 15 years were found to be meeting these guidelines. This

proportion was found to decrease in both groups in older children; in boys, the proportion of those meeting these guidelines decreased from 24% in 5 -7 year-olds to 14% in those aged 13 – 15. In girls, the decrease was from 23% down to 8% for the same age groups (HSCIC, 2014). In America, only 22% of children engage in the recommended amount of MVPA while 25% of boys and girls are classified as completely sedentary (Troiano, 2002). In an international study, only 25.6% of Maltese children were found to be physically active, one of the lowest figures amongst the countries surveyed. This same study revealed that Malta has the highest prevalence of overweight (25.4%) and obese (7.9%) youths in the surveyed countries (Janssen et al., 2005).

A recent study has shown that even moderate activity such as walking for about 15 minutes per day may help to reduce high calorie/sugary cravings and so contributes to minimising energy intake whilst enhancing energy expenditure (Ledochowski, Ruedl, Taylor, & Kopp, 2015).

The benefits of physical activity extend beyond the physical well-being of children and adolescents; it is associated with enhanced attention span (Gapin, Labban, & Etnier, 2011; Pellegrini & Bohn, 2005), achieving higher grades (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Gao & Xiang, 2014) and enhancing children socially and emotionally especially when the physical activity is carried out at school in non-curriculum time (Kahan, 2008; Ramstetter, Murray, & Garner, 2010), during which time children should be allowed to carry physical activities of their choice (Ridgers, Saint-Maurice, Welk, Siahpush, & Huberty, 2011; Ridgers, Stratton, & Fairclough, 2006). Further research is needed to establish whether offering organised physical activity during leisure time at school enhances physical activity levels in children and adolescents (McKenzie, Crespo, Baquero, & Elder, 2010).

Outdoor play increases physical activity in children (Baranowski, Thompson, Durant, Baranowski, & Puhl, 1993; Klesges, Eck, Hanson, Haddock, & Klesges, 1990) however the safety of outdoor unsupervised play is a realistic barrier in preventing this form of activity (Burdette & Whitaker, 2005). Hence after-school programmes would be an opportunity to supplant outdoor play in a supervised manner (Black et al., 2015; Burdette & Whitaker, 2005). Indeed, several recommendations have been made that schools should provide a substantial amount of children's physical activity before, during and after school to help them attain the guideline required levels (Black et al., 2015).

2.2 Screen time

Screen time, particularly television, has been clearly shown to have a large influence on childhood obesity (AAP, 2011; Jordan, 2007; Jordan, Kramer-Golinkoff, & Strasburger, 2008; Singh, Kogan, Van Dyck, & Siahpush, 2008); most often it equates to sedentary behaviour (Jago, Fox, Page, Brockman, & Thompson, 2010), the latter being defined as 'those activities requiring low levels of energy expenditure that include sitting or lying down' (Atkin et al., 2012). Sedentary children involve themselves less in MVPA (Mitchell & Byun, 2014; Mitchell et al., 2009) and time spent watching television or using electronic media may be replacing other more energy demanding activities such as free play equating to less energy expenditure (Veitch, Bagley, Ball, & Salmon, 2006). When sedentary screen time is changed to active screen time (e.g. using a video game that involves active movement such as a Wii game), energy expenditure is increased by more than 200% (Lanningham-Foster et al., 2006).

Several studies have consistently shown a relationship between sedentary behaviour, weight gain, chronic disease morbidity and mortality in both children and adults (Atkin et al., 2012; Granich, Rosenberg, Knuiman, & Timperio, 2010; Thorp, Owen, Neuhaus, & Dunstan, 2011);

children who carry out very little MVPA or view the most television are those who are most likely to be overweight or obese (Andersen et al., 1998; Granich et al., 2010) or of developing T2DM in children at high risk (Rockette-Wagner et al., 2015). Increased screen time in obese children also elevated their risk of developing hypertension (Pardee, Norman, Lustig, Preud'homme, & Schwimmer, 2007).

Another study showed that the risk of childhood obesity increases by 12% for every hour of television viewing per day (Hernandez et al., 1999). In fact, different forms of screen time have been directly associated with an increase in BMI for both boys and girls (Berkey et al., 2000; Peck, Scharf, Conaway, & DeBoer, 2015); decreasing television viewing time is associated with lowering in BMI (Robinson, 1999). Having a TV in the bedroom seems to be a greater predisposing factor to childhood obesity and increased screen time (He, Harris, Piche, & Beynon, 2009); in America, children aged 2 – 17 years watch more than 3 hours TV daily and 57% of them have a television in their bedroom (Whitaker, 2003). Studies have shown that this leads to more TV viewing and higher adiposity (de Jong et al., 2013; Dennison, Erb, & Jenkins, 2002; Sisson, Broyles, Newton, Baker, & Chernausek, 2011; Sisson, Sheffield-Morris, Spicer, Lora, & Latorre, 2014) and higher BMI (Janssen et al., 2005). Nearly 50% of obese American children studied engaged in screen time for more than 2 hours; only 33% of children with normal BMI reported this amount of screen time (Fulton et al., 2009; Sisson et al., 2009). A Maltese study revealed that 44% of boys and 28% of girls sampled aged 10 – 11 years spent more than one hour of screen time on weekdays; this percentage increased in the weekend (51% of boys and 35% of girls) (Decelis, Jago, & Fox, 2014b).

Excessive screen time together with low physical activity levels has also been negatively associated with other psychosocial and health issues such as anti-social behaviour, reduced

cognitive performance and poor sleep hygiene (Dworak, Schierl, Bruns, & Struder, 2007) and psychological distress in 4 – 12 year-old children (Hamer, Stamatakis, & Mishra, 2009).

Several authorities suggest that for children over 2 years of age, screen time should be limited to no more than 2 hours/day (Biddle, 2007; Peck et al., 2015; American Association of Pediatrics, 2001); for every hour of TV viewing on weekdays, BMI went up by 0.03 in children and the risk of developing T2DM increased by 3.4% (Rockette-Wagner et al., 2015). Girls who viewed more than 2 hours of TV daily were found to have a 13-fold likelihood of being overweight when compared to their peers who viewed less than 2 hours/day (Davison & Birch, 2001). Out of all of the children and adolescents who watch more than 2 hours TV per day, 17% of them are more likely to be overweight in adulthood (Hancox, Milne, & Poulton, 2004) and to consume less vegetables and fruit and consume high-calorie drinks than children who watched less TV (Salmon, Campbell, & Crawford, 2006). Another study revealed that adult obesity risk increased by 7% for every additional hour of TV viewing over the recommended amount by 5 year-olds in the weekend (Hancox et al., 2004; Viner & Cole, 2005).

When both screen time and physical activity recommendations are met, children are less likely to be overweight. In a study, only 10% of boys and 20% of girls who met both these criteria were overweight when compared to 35% of boys and 40% of girls who did not meet these criteria, both of which were shown to be equal risk factors for boys; for girls, however, physical activity had a far greater influence on lowering BMI (Laurson et al., 2008).

Screen time does not only contribute to childhood obesity because of its sedentary nature but also due to the increased eating of high energy foods, snacks and beverages during this time (Van den Bulck & Van Mierlo, 2004) especially those advertised on TV or other forms of

media (Halford, Gillespie, Brown, Pontin, & Dovey, 2004). In fact, more recent studies have shown that hours of screen time involving advertisement viewing were associated with increased BMI while screen time containing no commercials did not influence BMI (Zimmerman & Bell, 2010). Media advertisements influence 2 – 11 year-olds' demand for high-calorie foods/beverages; it is no surprise therefore that the food and beverage industry spend $1.6 billion annually on adverts directed to children (Fineberg, 2006). New regulations are now being implemented in many countries to control advertising to children on media together with recommendations from health authorities to parents to regulate screen time (Kelly et al., 2010).

2.3 Sweetened beverage consumption

Excessive consumption of sweetened beverages and its correlation with the prevalence of childhood obesity are a major health concern (Ludwig, Peterson, & Gortmaker, 2001; Tordoff & Alleva, 1990). According to the National Diet and Nutrition Survey UK, in 11 – 18 year-olds, the main source of non-milk extrinsic sugars (NMES) are soft drinks and fruit juice, with the former alone providing 30% of NMES daily intake (Public Health England, 2014).

Studies revealed that consumption of sweetened beverages has increased in children over 2 years old (Nielsen & Popkin, 2003, 2004; Rolls, Roe, & Meengs, 2006) and on average make up 51% of all beverages that they consumed in one day (Cullen, Ash, Warneke, & de Moor, 2002). This higher consumption is not only due to the number of times it is consumed per day or per week but also due to serving size; fifty years ago, the average serving was of 6oz, delivering about 75kcal. Serving sizes nowadays are as large as 64oz, containing roughly 800kcal, representing around half of the daily energy intake required by a sedentary 10 year-old boy or 12 year-old girl (Trumbo, Schlicker, Yates, & Poos, 2002).

Increased sweetened beverage consumption parallels total daily energy intake, with children who consume the largest amounts of these beverages increasing their energy intake by about 332 kcal daily when compared to children who drank no sweetened beverages (Cullen et al., 2002; Harnack, Stang, & Story, 1999; Ludwig et al., 2001; Mrdjenovic & Levitsky, 2003; Nielsen & Popkin, 2004; Raben, Vasilaras, Moller, & Astrup, 2002; Tordoff & Alleva, 1990; Troiano & Flegal, 1998). One study examined the consumption of soft drinks, fruit juice, fruit drinks, milk and diet soft drinks in a cohort of children. Only soft drinks (and not diet soft drinks) were associated with increasing BMI (0.01 unit per 100g soft drink consumed daily, equivalent to 0.036 units for every soft drink can consumed daily for 1 year) (Striegel-Moore et al., 2006). This has been corroborated by at least another study (Ludwig et al., 2001).

Fruit juice intake, especially in infancy, should assessed more closely; higher juice intake at 1 year of age was found to be associated with high sugar-sweetened beverage intake and higher BMI later in childhood (Sonneville et al., 2015; Wang, Bleich, & Gortmaker, 2008).

The increase in weight has been shown to be dose-dependent; the greater the amount of sweetened beverages consumed, the higher was the BMI (Mattes, Shikany, Kaiser, & Allison, 2011). Other studies, however, have failed to show this correlation (Blum, Jacobsen, & Donnelly, 2005; Nicklas, Yang, Baranowski, Zakeri, & Berenson, 2003; Vartanian, Schwartz, & Brownell, 2007) while others have demonstrated a negative correlation although there are some doubts in the methodology of some of these latter studies (Bolton-Smith & Woodward, 1994). On the other hand, reducing sweetened beverage consumption leads to weight loss in children with high BMI (Ebbeling et al., 2006); this is strongly supported by some scientific evidence (Vartanian et al., 2007) although other studies fail to show this (Mattes et al., 2011). It is highly unlikely that altering just one factor such as soft drink consumption will have such

a great impact on an individual's BMI (Ebbeling et al., 2006). However, studies which are less likely to find any association tend to be those studies with a weaker design (Vartanian et al., 2007). Some studies involved not only substitution of sugar-sweetened beverages with calorie-free soft drinks but also involved other factors such as training to encourage physical activity. Hence the outcome of the study could not be entirely attributed to decreased soft-drink consumption (Ebbeling et al., 2006).

Research has shown that lipogenesis is enhanced by fructose which is present in fruit juices (Bray, Nielsen, & Popkin, 2004; Havel, 2005). Physiologically, calories in a solid form give a better satiety response than liquid calories and hence the latter leads to a higher amount of calories being consumed if the beverage is sugar sweetened (DiMeglio & Mattes, 2000).

Children are being fed fast-food and sugar-sweetened beverages at a very early age (Fox, Pac, Devaney, & Jankowski, 2004). This affects food preferences later on in life by shaping one's diet early on in life (Birch & Fisher, 1998; Cowart, 1981) and is probably the reason why such beverages have become so strongly embedded in our culture (Fox et al., 2004; Skinner, Ziegler, & Ponza, 2004). Sweetened beverage consumption also causes lowering of milk intake and increases the risk of T2DM (Vartanian et al., 2007). Regular intake of sugar-sweetened beverages is positively correlated with T2DM, independently of whether the individual is obese or not. American and British data collected over the past 10 years show nearly two million new cases of T2DM; 4 – 13% of these could have been avoided if the individuals did not consume sugar-sweetened beverages or consumed water or unsweetened tea/coffee instead (O'Connor, Imamura, Lentjes, Khaw & Wareham, 2015). For every 5% total energy increase due to sugar-sweetened beverages, there is an 18% higher risk of developing T2DM (O'Connor et al., 2015; Sylvetsky Meni, Swithers, & Rother, 2015). In the UK, 1.7 – 5.6% of

cases of T2DM can be attributed to these beverages (Imamura et al., 2015). In an effort to reduce the incidence of T2DM, a decrease in the consumption of not only soft drinks, juices and squashes should be encouraged but also milkshakes and flavoured milk as a source of NMES (O'Connor et al., 2015).

Schools have a large part to play in the reduction of sugar-sweetened beverage consumption. The Institute of Medicine (2007) suggests that schools should allow only 'non-carbonated, non-flavoured and caffeine free water, 1% or non-fat milk and 100% juice in limited portions'. Parents should play their part too by limiting the availability of high-sugar foods and beverages in the household and that are made available to children at any instance (Fisher & Birch, 1999a, 1999b; Klesges, Stein, Eck, Isbell, & Klesges, 1991). The availability of healthy foods and beverages at home encourages healthy diets in 11 – 16 year-olds (Shepherd et al., 2006).

2.4 Sleep hygiene

The contribution of sleep hygiene towards childhood obesity has been studied much less than the effects of diet, energy intake and physical activity (Bass & Turek, 2005; Eisenmann, 2006a). Apart from limiting screen time to less than 2 hours per day as discussed previously, two other household patterns seem to be particularly important in preventing childhood obesity: (i) having an evening meal on a regular basis and with the family and (ii) getting an adequate amount of sleep at night (more than 10.5 hours for most children but varies with the age of the child) (Anderson & Whitaker, 2010). Both factors, i.e. good sleep hygiene and wholesome, balanced diets, have been shown to be equally important in the prevention of childhood obesity (Cespedes et al., 2016).

The majority of studies related to sleep hygiene and obesity rely on accurate self-reporting in older children/adolescents or on parental reporting in the case of younger children. A study showed that in adolescents and youths, there was a strong correlation between self-reporting via questionnaires and sleep logs and self-reporting and actigraphy (Chaput, Brunet, & Tremblay, 2006; Knutson & Lauderdale, 2007). However, the validity of parental reporting in younger children still needs to be established (Sekine et al., 2002); this is of utmost importance as it may affect the outcome of several studies carried out to date (Chen, Beydoun, & Wang, 2008).

There appears to be a strong negative correlation between hours of sleep and the risk of developing obesity at all stages of childhood. In a study of 5 – 10 year olds, children who slept the most had the lowest risk of being obese or overweight whilst those who slept between 8 and 10 hours per day had more than a three-fold risk of becoming obese (Chaput et al., 2006). The effect on childhood obesity may not be immediately apparent and may take some years; a cohort study in the UK showed that sleep deprivation (defined as those who slept for less than 10.5 hours per day) in 3 year-olds was associated with childhood obesity four years later (Reilly et al., 2005; Snell, Adam, & Duncan, 2007). Other authors reported that a sample of 10 – 16 year-olds who were overweight claimed to sleep for much less hours than their normal weight peers who slept an adequate number of hours (Beebe et al., 2007). Additional epidemiological studies carried out independently confirm these findings of a clear dose-response relationship between the two factors, i.e. lack of sleep and obesity (Agras, Hammer, McNicholas, & Kraemer, 2004; Hui, Nelson, Yu, Li, & Fok, 2003; Locard et al., 1992; Padez, Mourao, Moreira, & Rosado, 2005; Reilly et al., 2005; Sekine et al., 2002; Sekine, Yamagami, Handa, Saito, Kagamimori, 2002; von Kries, Toschke, Wurmser, Sauerwald, & Koletzko, 2002), however research carried out by other authors contradicts these results (Chaput et al., 2006;

Eisenmann, Ekkekakis, & Holmes, 2006; Knutson, 2005). This failure to find a correlation may be due to other factors such as gender differences which may affect results and which many authors do not take into consideration; one study which studied boys and girls separately showed that there seems to be a negative correlation between sleep and BMI in boys but not in girls (Eisenmann et al., 2006).

The recommended number of hours of sleep decrease with an increase in the age of the children due to changes in the circadian timing of sleep (Knutson & Lauderdale, 2007); children aged 5 years or under should sleep for 11 or more hours (Reilly et al., 2005; Sekine et al., 2002), those between 5 and 10 years old need not less than 10 hours of sleep (Amschler & McKenzie, 2005; Liu, Liu, Owens, & Kaplan, 2005) while children aged 10 or more should sleep for a minimum of 9 hours (Carskadon, 2005; Knutson & Lauderdale, 2007; Mercer, Merritt, & Cowell, 1998).

Questions arise as to whether disrupted or short hours of sleep are the cause or the effect of childhood obesity however several physiological mechanisms, mostly endocrine and metabolic, seem to link sleep duration with childhood obesity (Taheri, 2006a). Research carried out on obese children showed that more than a third of them reported binge-eating. Sleep disruption was greater in this latter group of obese children than in those who did not report binge-eating or had normal BMIs (Tzischinsky & Latzer, 2006). Children who do not sleep sufficiently often complain of fatigue and low activity levels and may have somatic and cognitive complications (Dinges et al., 1997; Sekine et al., 2002).

Physiologically, poor sleep hygiene leads to changes in the levels of certain hormones related to obesity, glucose control and appetite, such as leptin, ghrelin, insulin, cortisol and growth hormone, which, in turn, may contribute to energy imbalance, insulin resistance and

subsequent overweight/obesity (Chen et al., 2008; Spiegel et al., 2004; Spiegel, Leproult, & Van Cauter, 1999; Taheri, 2006; Taheri, Lin, Austin, Young, & Mignot, 2004). Obesity develops via many possible biological pathways which include increased cortisol and ghrelin levels, a reduction in the circulating levels of leptin and growth hormone and/or impaired glucose tolerance due to insulin resistance (Spiegel et al., 2004; Spiegel, Tasali, Penev, & Van Cauter, 2004; Taheri et al., 2004). Lack of sleep disrupts the diurnal rhythm of most of these hormones and these subsequently may have an effect on energy homeostasis (Mindell, Owens, & Carskadon, 1999), particularly energy expenditure and may contribute to increased appetite and selection of high-calorie foods (Taheri, 2006). Poor sleep hygiene could also influence childhood obesity by increasing sympathetic activity (Eisenmann, 2006b; Spiegel et al., 2004) and altering the thermic effect on food and non-exercise activity thermogenesis (Taheri, 2006a). Insulin resistance and deranged plasma lipoproteins profiles have also been recorded in children reporting sleep deprivation, the latter sometimes being due to excessive media exposure (Sayin & Buyukinan, 2016). Childhood obesity has also been directly linked to sleep apnoea which worsens with increasing degree of obesity. This, in turn, causes detrimental physiological and/or metabolic effects (Carotenuto et al., 2006; Mallory, Fiser, & Jackson, 1989).

3. CONCLUSION

Childhood obesity is a global health issue and evidence indicates that the problem is increasing worldwide although some authors report that the situation may be stabilizing in some instances (Datar & Chung, 2015).

Height and weight measurements and subsequent calculation of BMI is a primary strategy that is used to classify children into the relevant categories and is used to track shifts into higher or lower BMI categories by particular individuals over time (Sweeting, 2007).

Physical activity has been shown to have a negative correlation with childhood obesity and an important component of energy expenditure (Reilly et al., 2006) especially in the milieu of the ever-increasing calorific intake of children even at a very young age in the form of energy-dense foods and beverages (Fox et al., 2004) and increasing sedentary and inactive time spent viewing television or using other forms of screen media (Meyer et al., 2008). These factors, together with a lack of sleep, are contributing to the rise in chronic medical conditions usually associated with adults such as T2DM (Margeirsdottir, Larsen, Brunborg, Sandvik, & Dahl-Jørgensen, 2007), hypertension, hyperlipidaemia, metabolic syndrome and insulin resistance (Dietz, 1998; Hardy, Denney-Wilson, Thrift, Okely, & Baur, 2010; Martinez-Gomez et al., 2010; Ng et al., 2014).

Whilst all the four factors (lack of physical activity, screen time exceeding 2 hours per day in children over 2 years of age, sweetened beverage consumption and insufficient sleep) have been shown to contribute greatly to the childhood obesity epidemic, not all of these factors have been studied equally well, e.g. sleep hygiene has not been given as much attention by researchers as has physical activity (Bass & Turek, 2005; Eisenmann, 2006a). Local Maltese data is minimal or absent for some of these factors and hence more studies are required to

determine whether the effect of these four factors on childhood obesity is comparable to that shown in other international studies, hence giving some insight into whether successful interventions used globally may be used equally well locally.

Instead of viewing the factors affecting childhood obesity individually and as stand-alone contributing components, probably the most beneficial and effective method would be to deal with multiple issues together, e.g. activity, food and beverages, school and sports activities, sleep, etc. (Cai et al., 2014; Khambalia, Dickinson, Hardy, Gill, & Baur, 2012; Larson, Ward, Neelon, & Story, 2011; Nixon et al., 2012; Showell et al., 2013). The major contributory factors of childhood obesity may vary from one group of individuals to another due to differences in culture, environment, etc. and hence the interventions that are successful in one group of individuals may not necessarily be applicable to another cohort (Dixon, Pena, & Taveras, 2012; Flynn et al., 2006). Hence it is important to carry out local Maltese studies to identify the major contributing factors of childhood obesity and subsequently work on the best interventions needed locally based on best practices used in other cohorts which are as environmentally and culturally similar to our own. Therefore an investigation into the relationship of some known causes of childhood obesity (such as activity patterns, screen time, soft drinks consumption and sleep patterns) in Maltese children in relation to measures of BMI as a mode of classification of weight-to-height status is more than merited at this point in time.

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RESEARCH ARTICLE

Key words:

Body mass index, physical activity, soft-drink consumption, sleep, screen-time.

Journal appropriate to publication of paper:

Malta Medical Journal

Rationale:

This study would be of interest to local Maltese authorities involved in both the research and health sectors. The results of this study could be utilised to facilitate future studies in the field of childhood obesity and also to possibly instigate health promotion campaigns that are aimed at improving all the four factors that contribute to childhood obesity that have been investigated in this project.

ABSTRACT

Objective

The aim of this study was to show the rate of childhood obesity in 10 – 11 year old Maltese children attending year 6 in local primary schools in and to investigate whether a correlation exists between body mass index (BMI) and activity, screen-time, soft drinks consumption and sleep patterns in a cohort of Maltese children.

Methods

103 boys and girls (47% and 53% respectively; mean age 10.4 years) were sampled from four different primary schools serviced by the state, Church and independent entities. The students' height and weight were measured to determine their BMI. A questionnaire which dealt with the four areas under study was then distributed to all the participants. Data was analysed to determine whether the correlations under investigation were present.

Results

A negative correlation was found between BMI and (i) the number of different physical activities the students engaged in weekly, (ii) the average number of times that the students carried out these physical activities per week and (iii) the average number of hours of sleep per night reported by the children. A positive correlation was found between BMI and sugar-sweetened soft drink consumption. There seems to be no correlation between BMI and the different number of forms of screen-time the students engaged in or the total number of hours of screen-time although descriptive data shows that both factors increase with increasing BMI.

Conclusion

Similar studies on a larger cohort of participants should be considered in the future. The effect of involving parents, educators, general practitioners, paediatricians and other health care providers in the fight against childhood obesity should also be the primary focus of other studies.

1. INTRODUCTION

In the past three decades, childhood obesity has increased at an alarming rate and has become more common than underweight in many countries (NCD Risk Factor Collaboration, 2016). In the USA alone this has increased four-fold in 6 – 11 year-olds (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Ogden et al., 2006; Ogden, Carroll, & Flegal, 2008; Spear et al., 2007), with the average weight increasing by more than 5kg for 10 to 11 year-olds so that 30% of American children in this latter age group are either overweight or obese (Lobstein et al., 2015). Worldwide, 12.7 million or 20% of children in this age group have a BMI which is above the norm (Black, Menzel, & Bungum, 2015; CDC, 2015). However, recent studies have reported that childhood obesity appears to be on the decline in certain countries such as Canada (Rodd & Sharma, 2016). In the United Kingdom, a similar stabilisation in obesity in children appears to have occurred in 2 – 15 year-olds between 2004 and 2013 (van Jaarsveld & Gulliford, 2015) although other sources show that childhood obesity is still on the rise (Stamatakis, Wardle, & Cole, 2010). In 2014, 16% of British 2 – 15 year-old girls and 19% boys in the same age group were obese (HSCIC, 2015; National Obesity Observatory, 2014). There is evidence that this decline in rate of obesity is also occurring in younger American children aged 2 to 4 years (CDC, 2013) however this is not reproducible in adolescents (Ogden, Carroll, Kit, & Flegal, 2014).

Childhood obesity has now become a major health issue in the Maltese islands (Grech, 2006; Grech & Farrugia Sant'Angelo, 2009). In a 2012 study, almost 50% of Maltese 11 – 12 year-olds were found to be either obese or overweight (Decelis, Jago, & Fox, 2014), and hence Malta is one of the countries with the highest rate of childhood obesity both in Europe and worldwide (Janssen et al., 2005).

Grech et al. (2009) also noted that there was a difference in the BMI of children attending the different types of primary schools present in the current educational system available in Malta (i.e. State, independent and Church schools). They also noted that children attending independent schools tended to be the least obese (Grech & Farrugia Sant'Angelo, 2009).

International studies have shown that physical inactivity or an inadequate amount of moderate or vigorous activity, prolonged screen time (sedentary time spent watching television, playing on mobile screen games, using computers or smartphones to play games or access the internet) (Burdette & Whitaker, 2005), high consumption of soft drinks, soda or other sugar-sweetened beverages (Barlow, 2007; Katzmarzyk et al., 2013) and lack of sleep (Chen, Beydoun, & Wang, 2008) all predispose to childhood obesity. A recent publication reported that Maltese children spend a lot of their free time watching television and using computers and do not participate much in organised activities such as sports (Cefai & Galea, 2016).

This study aims to confirm previous studies that showed the incidence of childhood obesity in Maltese 10 – 11 year-old children (Grech & Farrugia Sant'Angelo, 2009) as well as provide indications of the likely causes of obesity (namely activity patterns, screen time, soft drinks consumption and sleep patterns) in Maltese children.

2. METHODS

2.1 Participants

Primary school education in Malta is serviced by three different providers: the state, the Church (most of which are run by the Maltese Curia) and private or independent entities. State schools are free for all children whose families are residing in Malta and adopt a co-educational system. Church schools are also free however each individual school caters for a particular sex only. Attendance at independent schools is subject to a fee and most of these schools have a co-educational system.

Children (both males and females) attending year 6 (aged 10 – 11 years) in all these three different types of schools during the scholastic year 2015 – 2016 were eligible to be included in this study. From data gathered from the Education Department of Malta (see data from personal communication with the Department of Education - Appendix 1), there were 4022 ten to eleven year-old children attending year 6 in all Maltese schools during the scholastic year 2015 – 2016. Using a confidence level of 95% and a confidence interval of 10, the sample size needed for this study was calculated to be of 94 individuals (see Appendix 2). The sample was then apportioned according to the ratio of the number of students attending all the three different types of primary schools present in Malta (Church, State and Independent) during this academic year (refer to Appendix 3).

2.2 Research design

Four primary schools were randomly chosen from geographically distinct areas on the island and asked permission for sampling - one state school, two Church schools – a boys' and a girls' school (to gather data from both sexes) – and an independent co-education school. All the schools which accepted to participate in this study were initially given participant information

sheets (PIS) (Appendices 4 and 5), parental consent forms (PCF) (Appendices 6 and 7) and letters of invitation (Appendices 8 and 9) in both Maltese and English. The PIS and PCF were given an individual child participant number to maintain the anonymity of the participants. These three documents were then distributed by the respective school authorities to a number of children attending year 6 as determined by the sample ratio (Appendix 3). The children then passed these documents on to their respective parents/guardians to read and sign. The children then brought the compiled consent forms back to school with them once these were duly filled within a pre-established deadline.

On the day of data collection, the signed consent sheets bearing the individual child participant number were collected from those children whose parents/guardians had consented to their child's participation. Each individual child's height and weight was then measured (see section 2.3 for measurement procedure) and a questionnaire (Bervoets et al., 2014; Hardy, Booth, & Okely, 2007; Hedrick, Comber, Estabrooks, Savla, & Davy, 2010; Silva, Silva, Braga, & Neto, 2014) (Appendices 10 and 11) in Maltese or in English, bearing the individual child participant number already allocated, was given to each child. The questionnaire dealt with the four main areas of concern of this study: physical activity, screen-time, soft drinks consumption and sleep (see Appendix 10 and 11). The questionnaires were completed in class in the presence of the researcher who explained each question; compilation was aided by the researcher where necessary. Children who had not been consented by their parents/guardians to participate in this study were asked to draw a chart on the theme 'Healthy eating at school and at home' during the measurement procedure and the completion of the questionnaire.

2.3 Measurement procedures

All measurements were carried out by the researcher using a portable stadiometer (Seca Portable Stadiometer) and portable digital scales (Detecto PD200 Digital Weighing Scales). The students' height and weight were measured with students wearing their school uniform PE shorts and T-shirt and socks but without shoes and as outlined by the NHANES Anthropometry procedures manual (Appendix 12) (NHANES, 2011) by the researcher in the presence of a gender-appropriate member of staff (Ikeda, Crawford, & Woodward-Lopez, 2006; Nihiser et al., 2009). Respective WHO growth charts for boys and girls (Appendices 13 and 14) (CDC, 2000) were used to calculate and classify the children's BMI (Grummer-Strawn, Reinold, & Krebs, 2010).

2.4 Data analysis

The anthropometric data and data gathered from the questionnaire were entered into SPSS version 22 and descriptive statistics and a Spearman rho correlation were carried out to determine whether there was any correlation between the children's BMI and the four studied causes of childhood obesity (i.e. physical activity, screen time, sugar-sweetened or soft-drinks consumption and sleep). Responses to questions of nominal measurements (questions 2 – 4, 8, 9, 13, 14) were scored from 1 upwards in the order the responses appeared in the respective questions. All other responses yielded numerical data and hence did not require scoring.

3. RESULTS

3.1 Anthropometric considerations

33 students from all the schools visited and whose parents or guardians had consented to their participation in this study were absent on the day of sampling; hence a total of 103 boys and girls (53% girls, 47% boys) with a mean age of 10.4 years were eventually sampled (see Appendix 3) from randomly selected schools included in a list available from the Education Department. None of the students sampled had mobility issues and could therefore influence data gathered on physical activity or BMI.

Comparative summary statistics for weight, height and BMI value together with the BMI classification (according to the WHO growth charts) of all the students studied and the percentage of overweight and obese students by gender are shown in tables 1 to 3 respectively.

Table 1. Comparative summary statistics for weight, height and BMI

	Weight/kg	***Height/cm***	***BMI/kg m^{-2}***
Minimum	22.5	124.0	13.4
Maximum	104.0	164.0	49.5
Mean	40.3	141.4	19.9
SD	12.8	7.9	5.0
Mean - males	40.2	140.0	20.2
SD - males	14.8	8.1	5.9
Mean - females	40.4	142.6	19.7
SD - females	10.9	7.7	4.2

Table 2. BMI classification of students studied

BMI classification	*Number of students*	*%*
Underweight	2	1.9
Normal	65	63.1
Overweight	18	17.5
Obese	18	17.5
Total	103	100.0

Table 3. Percentage of overweight/obese children sampled by gender

	Number of male students	*Number of female students*	*Total*
Overweight (N)	8	10	18
Overweight (%)	7.8	9.7	17.5
Obese (N)	9	9	18
Obese (%)	8.7	8.7	17.5

The mean weight for both genders is similar however the mean female height is slightly higher, leading to a lower mean BMI for the female cohort (see Table 4).

Table 4. Comparative summary statistics for BMI by gender

	Males	*Females*
Mean/kg m^{-2}	20.229	19.7
Standard error	0.854	0.6
SD	5.916	4.2
N	48	55
% of total sample	46.6	53.4

35% of the students sampled were either overweight (7.8% males, 9.7% females) or obese (8.7% for each gender) whilst less than double this percentage (65%) had a normal BMI. A noticeably small percentage (1.9%) were underweight.

Table 5. Comparative summary statistics for BMI by school attended

	State	***Church***	***Independent***
Mean/kg m^{-2}	20.724	19.421	18.270
Standard error	0.852	0.614	0.847
SD	6.023	4.026	2.678
n	50	43	10
% of total sample	48.5	41.7	9.7

When comparing student BMI according to the type of school attended, students attending the Independent school had the lowest average BMI (18.3 kg m^{-2}) whilst those attending the State school had the highest average BMI (20.7 kg m^{-2}).

3.2 Factors affecting childhood obesity

Table 6 (Appendix 19) shows the descriptive data gathered by the questionnaire for all the four factors affecting obesity that are under investigated. Appendix 20 shows the graphical interpretation of this descriptive data. The mean number of different physical activities carried out weekly increases from underweight to overweight respondents but decreases for the obese individuals (figure 1). However the mean number of times respondents carry out each physical activity per week decreases with increasing BMI (figure 2). The number of different forms of screen time used together with the hours of screen time viewed on weekdays and weekends increases with BMI (figures 3 – 5). Water consumption decreases with increasing BMI (figure 7) but sugar-sweetened beverage consumption (figure 9) as well as other beverages such as iced tea, tea, coffee, etc. increases with increasing BMI (figure 12). Consumption of non-sweetened beverages and milk increases from underweight to overweight individuals but decreases in the obese (figures 10 and 11). Fruit juice consumption is similar in all BMI groups except in the underweight where it is less (figure 8). Slight

differences exist in the number of hours of sleep per night with an increase from underweight to children with a normal BMI but this decreases in the obese (figure 13).

Tests for normality were carried out on all the factors for which a correlation with BMI was being sought. After consulting the Kolmogorov-Smirnov statistic, the *p* values were found to be less than 0.05 in all cases, showing that the assumption of a normal distribution was violated and hence a non-parametric approach was adopted. The results of a Spearman rho correlation between BMI and factors related to the four main areas of focus (physical activity, screen-time, soft drinks consumption and sleep) are shown in Table 7. The strength of the correlations was then determined as suggested by Cohen and Holliday (1996).

Table 7. Correlation of BMI and factors affecting childhood obesity

Correlation of BMI with	*p value*	*r value*	*Strength of correlation*
number of activities	0.038	-0.204	low correlation
average times activities carried out per week	0.005	-0.274	low correlation
number of forms of screen on weekdays	0.708		
hours of screen time on weekdays	0.172		
number of forms of screen on weekends	0.814		
hours of screen time on weekends	0.460		
weekly water consumption	0.070		
weekly fruit juice consumption	0.984		
weekly non-diet soft drink consumption	0.025	0.221	low correlation
weekly diet soft drink consumption	0.833		
weekly milk consumption	0.504		
weekly consumption of other drinks	0.285		
average number of hours of sleep nightly	0.005	-0.273	low correlation

There was a low negative correlation between BMI and the reported number of physical activities that the students carry out. This was also observed between BMI and the weekly average number of times these physical activities are carried and BMI and the reported average number of hours of sleep per night. On the other hand, a positive correlation was

observed between BMI and non-diet soft drink consumption per week; however, this was not replicated for any of the other forms of beverages investigated. No correlation was observed for either the number of forms of screen-time utilised by the students or the number of hours of screen-time during both the weekend and on weekdays.

3.2.1 Physical activity

Forty-five students (43.7%) reported that they spent most of their school recess running and playing hard compared with 33.9% whose activity ranges from sitting down to slight activity (Appendix 15). More than half of the cohort studied (53.4%) said that they were always very active during PE classes; none of the students reported that they never take these classes (Appendix 16).

Data related to after school hours activities showed that 40 students (38.8%) never took part in after school activities, with the percentage decreasing in an inversely proportionate manner when compared to the number of weekly activities. 32.0% participated in physical activity in the evening 2 or 3 times a week compared to 21.4% who never took part in physical activity at this time. 60 students (58.2%) reported that they participated in physical activity at least once or twice during the weekend (Appendix 17).

3.2.2 Sleep patterns

Just over one fifth of the students (22.3%) stated that they had a regular bedtime and 36.9% slept for the same number of hours each night. At the other extreme, 32 (31.1%) and 28 (27.2%) students respectively reported irregular bedtime and number of hours of sleep (Appendix 18).

4. DISCUSSION

Childhood obesity is increasing at an alarming rate worldwide (Stamatakis et al., 2010; Wang & Lobstein, 2006). According to the World Health Organisation (WHO) (2016) Commission on Ending Childhood Obesity, in the 23 years between 1990 and 2013, the number of obese children up to the age of five years has increased worldwide from 32 million to 42 million; half of these children live in the WHO African Region (WHO, 2016). However, some authors have reported stabilisation or decline in certain countries (Rodd & Sharma, 2016; van Jaarsveld & Gulliford, 2015). Studies have revealed that Malta is not an exception in this regard (Grech, 2006; Grech & Farrugia Sant'Angelo, 2009; Saliba, 2015). Although this study was carried out on a small number of students (especially those attending Independent schools) aged ten to eleven years attending year 6, the anthropometric data and data related to the four factors related to childhood obesity concurred with that found in other local studies and studies carried out in the UK and worldwide.

4.1 Anthropometric data

The anthropometric data obtained in this study agrees with data available from a study carried out by Grech and Farrugia Sant'Angelo in 2011 (Grech & Farrugia Sant'Angelo, 2011); the mean BMI of females studied was lower (Table 4) although the mean weight of both genders was relatively similar (Table 1). The ranges of weight, height and BMI were relatively wide, so that individuals with anthropometric values at either side of the spectrum could have skewed the data somewhat. The prevalence of underweight children studied (1.9%) was low when compared to the percentages obtained for the other BMI categories (Table 2) as has been observed in other countries (NCD Risk Factor Collaboration, 2016); further studies could follow whether this will decrease over time as has been reported in the UK and worldwide

(de Onis, Blössner, Borghi, Frongillo, & Morris, 2004; White, Rehkopf, & Mortensen, 2016). The surveyed cohort also showed similar differences in BMI according to the school attended (Table 5) as was shown by Grech *et al*. (2011); the children with the lowest BMI were those attending independent schools whilst those with the highest BMI attended state schools. Overall, the percentage of overweight girls (Table 3) was slightly higher than that of boys (9.7% compared to 7.8%) although obesity seems to be equally prevalent in both genders (8.7%).

The National Child Measurement Program (NCMP) carried out annually in England measures the height and weight of approximately one million children. From the latest data available for measurements taken during 2014 and 2015, 19.1% of children aged ten to eleven years and attending year 6 were found to be obese while another 14.2% were obese (National Obesity Observatory NOO, 2016). The data obtained from the Maltese cohort under consideration in this study correlates well with the UK figures; 17.5% were found to be overweight while a further 17.5% were obese.

4.2 Factors affecting childhood obesity

4.2.1 Physical activity

Physical activity is important in improving cardiovascular function in children with high BMI (Dias, Green, Ingul, Pavey, & Coombes, 2015) amongst other benefits such as psychological well-being (Lobstein, Baur, & Uauy, 2004) and hence its consideration in relation to childhood obesity is of utmost importance.

The number and frequency of activities that students reported generally decreased in obese children and showed a negative correlation with recorded BMI (Table 7). This is in agreement with several studies carried out by other authors (Butte et al., 2016; Dwyer, Coonan, Leitch,

Hetzel, & Baghurst, 1983; Singh, Siahpush, & Kogan, 2010; Yin et al., 2005) especially when children engaged in after-school activities (Gutin & Owens, 1999; Yin et al., 2005). In the surveyed group, 33.9% reported that they carried out no or slight physical activity at recess (Appendix 15), 20.3% stated that they were not so active during their physical education (PE) lessons (Appendix 16) while more than a fifth reported no after-school activity (38.8%) or in the evenings (21.4%) or during weekends (21.4%) (Appendix 17). This raises concerns whether increasing BMI could be tied to these levels of inactivity. Perhaps school authorities should encourage parents to ensure that children involve themselves in at least one hour or more of physical activity a day in a bid to prevent obesity (Burdette & Whitaker, 2005a; 2005b).

Further local studies should look into (i) the amount of outdoor play and reasons that prevent children from engaging in it (ii) the time allotted for recess and physical education lessons in all Maltese schools. Prospective studies may also consider the use of device-based measurements to obtain a clearer picture of the sedentary versus active time of children and its impact on health outcomes.

4.2.2 Screen-time

This study showed that the mean number of hours of screen time viewed on weekdays and weekends increased with increasing BMI even though Spearman rho correlation analysis revealed no correlation between the BMI and the number of forms of screen entertainment perused or the number of hours of screen-time either during the week or on weekends reported by the children surveyed (Table 7). Descriptive data analysis therefore agrees with several studies carried out on this theme; one particular study showed that excessive TV viewing over the recommended time (<2 hours/day) was associated with increased risk of obesity (Hancox, Milne, & Poulton, 2004; Jordan, 2007; Meyer et al., 2008; Peck, Scharf,

Conaway, & DeBoer, 2015; Reilly et al., 2005; Robinson, 1999; Whitaker, 2003). However some of these studies did not rely on self-reporting but were indirectly reported by parents/guardians. The risks associated with physical inactivity due to hours sitting down is well documented (Petersen, Bauman, & Tolstrup, 2016). This study has relied on self-reporting by the children surveyed and recall and could have yielded different results had a daily log been filled in, possibly by parents or guardians (Adams, Soumerai, Lomas, & Ross-Degnan, 1999; Sallis & Saelens, 2000). Also, the sample size could have had an effect on this outcome; e.g. only 10 children attending independent schools were surveyed. Larger sample numbers and the inclusion of time spent on mobile phones (as children might borrow these to play games for example) could have possibly altered the results.

Further studies may enrol parents or guardians to maintain a daily log of their children's screen time, thus also making them conscious of the time spent by their children in engaging in this form of entertainment. The effect of on-screen advertising on Maltese children's food preferences may also be investigated and compared with other similar studies (Kunkel & Wilcox, 2004).

4.2.3 Soft-drinks consumption

The data obtained in this study shows that, out of all the different types of beverages examined, only consumption of sugar-sweetened soft-drinks shows a positive correlation with BMI and increases with increasing BMI. This is concordant with research carried out by other authors (Ebbeling et al., 2006; Ludwig, Peterson, & Gortmaker, 2001; Mattes, Shikany, Kaiser, & Allison, 2011; Striegel-Moore et al., 2006; Vartanian, Schwartz, & Brownell, 2007). Evidently, fat storage and lack of satiety is promoted with consumption of sugar, especially in

soluble form, and this is independent of physical activity levels or the individual's weight (Malhotra, Noakes, & Phinney, 2015).

School-based interventions on soft-drink consumption have been shown to be effective in decreasing weight in children (James, Thomas, Cavan, & Kerr, 2004). Hence further studies could look into the effect of (i) limiting or restricting soft-drink availability in vending machines on or near school premises or (ii) introducing school policies that ban sugar-sweetened soft-drinks on school premises. If childhood obesity were to be given as much due importance as smoking on school premises, then authorities should set standards for foods and beverages that are sold in and around a determined radius around local schools.

Soft-drinks tax may have a greater effect on childhood obesity than other actions taken to date (McCarthy, 2014; Torjesen, 2015). Studies on whether such a tax would have the predicted effect on obesity in children should be carried out without delay in countries implementing this tax.

The involvement of parents may be essential in establishing when, where and how much soft-drinks are consumed by younger children, hence reinforcing good dietary habits (Fisher & Birch, 1999). Future studies may investigate (i) whether an educational campaign for parents of children who are heavy sugar-sweetened drinks consumers has any positive effects on childhood obesity and (ii) whether there is a difference in the level of sugar-sweetened drinks consumption in children from various socio-economic backgrounds in Malta.

However this study depended on self-reporting and recall; future studies may consider the use of a daily log of all the beverages consumed over a longer period and at different times of the year, e.g. in summer and in winter.

4.2.4 Sleep hygiene

77.7% of the children taking the questionnaire stated that they did not have a regular bedtime while 63.1% said that they did not sleep for the same number of hours each night. The study also shows a negative correlation between the number of hours of sleep and the BMI of the children surveyed; this is in agreement with other studies (Chaput, Brunet, & Tremblay, 2006; Tzischinsky & Latzer, 2006). However the association between childhood obesity and sleep (Bass & Turek, 2005; Eisenmann, 2006; Jiang et al., 2015; Reilly et al., 2005; Sekine et al., 2002; Tzischinsky & Latzer, 2006) and whether there are any gender differences (Chen et al., 2008; Jiang et al., 2015) has not received enough attention. It still remains to be seen whether it is obesity that causes sleep deprivation or vice versa (Chaput et al., 2006). Yet studies carried out on adults have shown a possible mechanism for the relationship between lack of sleep and weight gain (Spiegel, Tasali, Penev, & Van Cauter, 2004).

This study has relied on self-reporting of patterns of sleep; the validity of self- or proxy-reported sleep patterns also needs to be assessed (Chen et al., 2008).

4.3 Other considerations

Further studies should examine the role of parents or guardians and general practitioners (Taveras et al., 2015) and of educators and school setting (Lobstein et al., 2015) in reduction and future prevention of childhood obesity.

Parents and guardians play a vital and effective role in the prevention of childhood obesity (Evans, Finkelstein, Kamerow, & Renaud, 2005; Taylor et al., 2015) however parental interventions are seldom the central feature of childhood obesity studies (American Dietetic Association, 2006; Neumark-Sztainer, 2005; Patrick & Nicklas, 2005). The challenge lies in educating children's carers to identify that obesity in children is a serious health threat and

to act as role models who determine sound policies that encourage physical activity and healthy eating habits and overcome environmental factors that enhance childhood obesity (Fineberg, 2006; Patel, 2005; Saliba, 2015). Another challenge lies in helping parents/guardians of overweight and obese children to correctly perceive the weight status of their children (Duncan, Hansen, Wang, Yan, & Zhang, 2015; Etelson, Brand, Patrick, & Shirali, 2003). Parents must also be educated to actuate the necessary changes in the children's diet via planned shopping and cooking, making more fruit and vegetables available as snacks, controlling portions, reducing the availability of sugar-sweetened beverages, creating more family meals, setting time limits on the use of electronic equipment and screen-time in general and to encourage more outdoor and active play as part of children's daily routine.

Very few general practitioners, paediatricians and health care providers routinely include a BMI assessment as part of children's health visit (Barlow, Bobra, Elliott, Brownson, & Haire-Joshu, 2007; Barlow, Dietz, Klish, & Trowbridge, 2002; Gerner, McCallum, Sheehan, Harris, & Wake, 2006; Perrin, Flower, & Ammerman, 2005; Perrin, Flower, Garrett, & Ammerman, 2005; Andersen, Christensen, Obel & Sondergaard, 2012; Wethington, Sherry & Polhamus, 2011) and hence health authorities may consider encouraging routine weight and height assessment, and advice and reinforcement to the parents and guardians of overweight and obese children (Barton, 2010). If obesity were to be considered as a serious health issue as other health problems in children such as visual or hearing impairment or scoliosis, then screening programmes and appropriate referral systems and services would be set up.

Prospective studies on dietary preferences of children especially on fat intake may also be considered; a recent study has shown that overweight/obese children possibly have a genetic

component that makes them be less capable than leaner subjects to detect fats in their food (Sayed et al., 2015).

5. CONCLUSION

Childhood obesity is increasing worldwide and is now a major public health concern in the Maltese Islands. Anthropometric data collected in this study has correlated well with that available from previous local studies and also recent data available from the UK.

The study has shown that a low negative correlation exists between the number of different physical activities carried out and BMI and between the average number of times children reported to engage in physical activity on a weekly basis and BMI. This is in agreement with several other studies carried out by other authors in the UK and elsewhere.

A positive correlation between sugar-sweetened beverage consumption and BMI was also shown to exist however this was not replicated with other types of beverages investigated. A negative correlation was established between the reported average number of hours of sleep and BMI. Both of these latter correlations mirror the results of other studies carried out internationally.

No correlation, however, was found to exist between BMI and either the number of forms of screen entertainment used by children or the number of hours of screen time reported by them.

The number of participants studied may have been too small, especially when considering the Independent school cohort, to accurately determine certain parameters and correlations; however, this study may possibly be considered as a pilot for a larger national research project.

Researchers should look at both energy intake and output when seeking to prevent childhood obesity (Jensen et al., 2014) as most studies apply a strong focus on the nutritional component

with the scope of controlling energy intake and tend to neglect the importance of physical activity as the major contributor to energy expenditure control in the act of balancing out energy (Hawkes et al., 2015; Kumanyika et al., 2008; Portella & Silveira, 2014).

Parental education and involvement in the fight against childhood obesity should imperatively be given due consideration and should be the primary focus of future studies. General practitioners, paediatricians, health care professionals and educators should all be more actively engaged in raising awareness of childhood obesity amongst parents, guardians and also children themselves.

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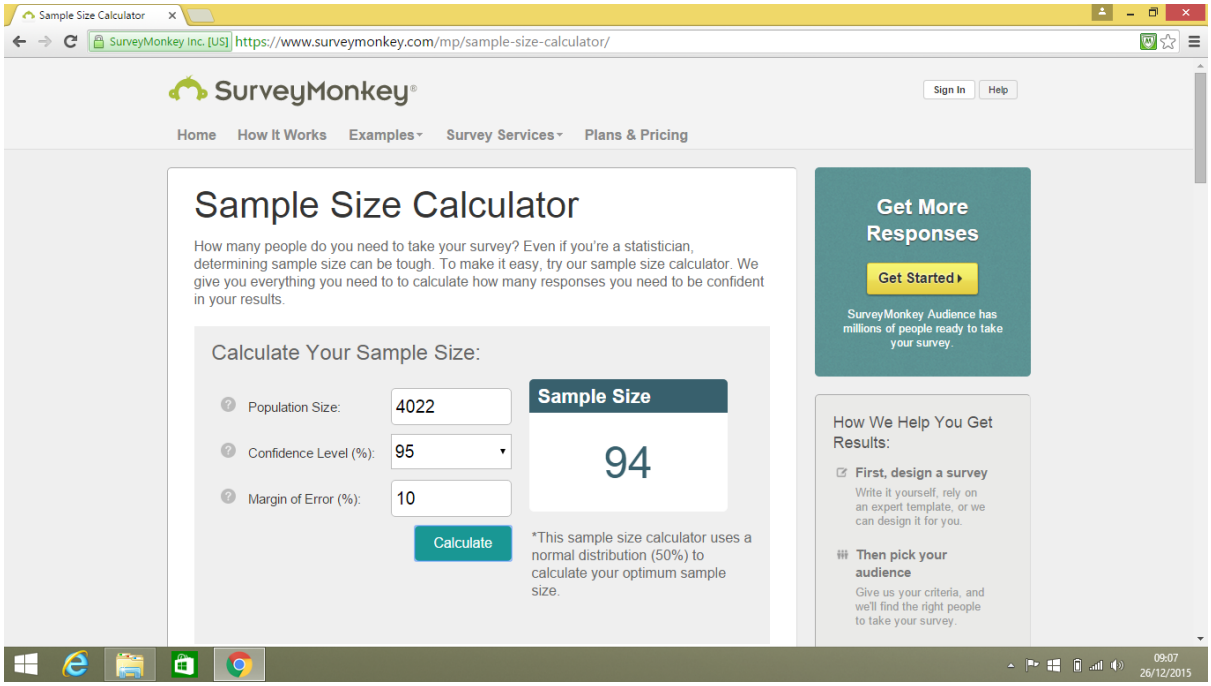
APPENDIX 1 – CONFIRMATION OF POPULATION SIZE

Table 8. Students Enrolled in Year 6 for academic year 2015/2016 as October 2015. Data provided by Education Department of Malta (personal communication)

	State	Church	Independent
Males	1,144	659	265
Females	1,073	669	212
Total	2,217	1,328	477

APPENDIX 2 – SAMPLE SIZE CALCULATOR



APPENDIX 3 – NUMBER OF STUDENTS SAMPLED

Table 9. Table showing estimated students to be sampled and actual numbers sampled

School	Students attending	Percentage of N	Number of students to be sampled	Actual number of students sampled	
State	2217	55.1	52	50	
Church	1328	33.0	31	43	
Independent	477	11.9	11	10	
	4022 (*N*)		***94***	***103 (n)***	***Total***

APPENDIX 4 – PARTICIPANT INFORMATION SHEET IN ENGLISH

Participant information sheet

Assessment of causes of childhood obesity in 11 year-old Maltese children

Your daughter/son is being invited to take part in a research study. Before you decide to allow your daughter/son to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to allow your daughter/son to take part.

Thank you for reading this.

What is the purpose of the study?
This research is being undertaken on 11-year-old Maltese children attending year 6 of primary school. The project is to find out whether certain factors which have been found to cause obesity in children, such as lack of activity, hours spent watching TV or playing video games, lack of sleep or consuming soft drinks, are also present in Maltese children.

Why has my daughter/son been chosen?
Your daughter/son has been chosen because s/he is currently attending year 6 in a Maltese primary school.

Does my daughter/son have to take part?
It is up to you to decide whether or not your daughter/son takes part. If you decide to allow him/her to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to allow him/her to take part you are still free to withdraw his/her participation at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect you or your daughter/son in any way.

What will happen to my daughter/son if s/he takes part?
The height and weight measurements of your daughter/son will be taken. They will then be given a questionnaire on activity, sleep, screen time and soft drink consumption to answer at school in the classroom (duration about 15 minutes).

What are the possible disadvantages and risks of taking part?
There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?
By taking part, your daughter/son will be contributing to the development of a set of recommendations for the prevention and treatment of childhood obesity.

What if something goes wrong?
If you wish to complain or have any concerns about any aspect of the way in which your daughter/son has been approached or treated during the course of this study, please contact Dean of the Faculty of Medicine, Dentistry & Clinical Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, 0044 1244 511000

Will my daughter/son taking part in the study be kept confidential?
All information which is collected about your daughter/son during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information.

Participants should note that data collected from this project may be retained and published in an anonymised form. By agreeing to participate in this project, you are consenting to the retention and publication of data.

What will happen to the results of the research study?
The results will be written up into a dissertation for my final project of my MSc. Individuals who participate will not be identified in any subsequent report or publication.

Who is organising the research?
The research is conducted as part of a MSc in Weight Management within the Department of Clinical Sciences & Nutrition at the University of Chester. The study is organised with supervision from the department, by Doreen Micallef, an MSc student.

Who may I contact for further information?
If you would like more information about the research before you decide whether or not you would be willing to allow your daughter/son to take part, please contact:

Doreen Micallef. 1323313@chester.ac.uk.

Thank you for your interest in this research.

APPENDIX 5 – PARTICIPANT INFORMATION SHEET IN MALTESE

Taghrif ghal partecipanti ta' dan l-istudju

Studju dwar il- fatturi li jikkawzaw l-obezita' fi tfal Maltin ta' hdax il-sena

It tifel/tifla tieghek qed jigu mistiedna jippartecipaw fi studju ta' ricerka. Qabel ma inti taghti il-kunsens tieghek ghal dan, huwa importanti li inti tifhem ghalfejn u kif ser issir din ir –ricerka. Ghalhekk nixtiequ li taqra sew dan li gej biex jekk trid tkun tista wkoll tiddiskutieh ma' ohrajn. Jekk hemm xi haga li trid aktar spjegazzjoni dwarha jew jekk tixtieq aktar taghrif, nistiednuk taghmel kuntatt maghna. Nixtiequ li tiehu z-zmien necessarju qabel ma taghmel id-decizjoni biex thalli t-tifel/tifla tieghek jiehu/tiehu parti fl-istudju.

Nirringrazzjawk tal-hin tieghek biex taqra dan it-taghrif li gej.

X'inhu l-iskop ta' din ir-ricerka ?

Dan l-istudju qieghed isir fuq tfal Maltin li ghandhom hdax il-sena u li jattendu year 6 ta' l-iskola primarja. L-ghan ta' l-istudju huwa li jidentifika jekk diversi fatturi li nafu li jikkawzaw l-obezita' fit-tfal, bhal ma huma n-nuqqas ta' attivita fizika, in–numru ta' sieghat li t-tfal iqattghu quddiem it –TV jew jilghabu l-*video games* , in–nuqqas ta' l-irqad u l-ikkunsmar ta' luminati, humiex prezenti wkoll fil-kaz ta' tfal Maltin.

Ghalfejn qed jintaghzel/ tintghazel it–tifel/tifla tieghi?

Dan qed isir biss ghax hu/hi qieghed/qeghda jattendi/tattendi year 6 fi skola primarja f'Malta.

It- tifel/tifla tieghi huma obbligati jiehdu sehem fl-istudju?

Id-decizjoni biex it-tifel/tifla jippartecipa/tippartecipa fl-istudju hija tieghek. Jekk inti taqbel li jiehu/tiehu sehem, tinghatalek din il-formola biex izzomm flimkien ma' ohra fejn tiffirma l-kunsens tieghek. Jekk jinghata l-kunsens ghall-partecipazzjoni, xorta wahda jista' jigi rtirat fi kwalunkwe stadju ta' l-istudju minghajr ma tintalab spjegazzjoni. Decizjoni li ma tiehux sehem, jew li tirtira l-kunsens, ma ghandha l-ebda konsekwenza kemm ghat-tfal u l-anqas ghal genituri.

Fl-istudju xi jsir fuq min qieghed jippartecipa?

Jittiehed it-tul u l-piz tat-tifel/tifla, li wara jinghataw kwestjonarju dwar attivita' fizika, rqad, sieghat ta' TV/ *video games* u konsum ta' luminati; din il-formola timtela fil -klassi u ma tiehux aktar minn 15 il-minuta.

Hemm xi zvantaggi jew riskju ghal min qieghed jiehu sehem?

Ma hemm l-ebda riskju jew zvantagg iehor ghall-partecipant.

X'inhuma l-beneficcji ta' dan l-istudju?

Bil-partecipazzjoni taghhom, it-tifel/tifla tieghek ikunu qed jaghtu sehem biex jigu zviluppati rakkomandazzjonijiet ghal prevenzjoni u l-kura ta' l-obezita' fit-tfal.

X'jigri jekk nixtieq naghmel xi oggezzjoni?

Jekk inti ghandek xi oggezzjoni jew hemm xi haga tinkwetak dwar xi aspett tal-mod kif it-tifla/tifel tieghek giet/gie avvicinat/a jew trattat/a matul dan l-istudju, nistednuk tikkuntattja lid-Djaknu tal-Fakulta' tal-Medicina, Dentistrija u Xjenzi Klinici, University of Chester, Parkgate Road, Chester, CH1 4BJ, 0044 1244 511000.

Il-fatt li t-tifel/tifla tieghi hadet sehem f'dan l-istudju jinzamm kunfidenzjali?

Kull informazzjoni li tigi migbura minghand it-tifla/tfel tieghek tul din ir-ricerka tinzamm kunfidenzjali u huwa biss ir-ricerkatur li qed imexxi dan l-istudju li jkollu access ghal din l-informazzjoni.

Informazzjoni li tigi migbura minn dan l-istudju tista' tinzamm u tigi ppublikata b'mod anonimu. Jekk taqbel mal-partecipazzjoni f'din ir-ricerka, tkun qed taghti l-kunsens tieghek biex l-informazzjoni tkun tista' tigi mizmuma u ppublikata.

X'jigri bir-rizultati ta' dan l-istudju?

Ir-rizultati ser jigu wzati f'tezi ghall-progett finali ta' l-MSc tieghi. L-identita' tal-partecipanti ma tigi mikxufa fl-ebda rapport jew publikazzjoni li tohrog minn dan il-progett.

Min qed jorganizza din ir-ricerka?

Ir-ricerka qed issir bhala parti minn MSc in Weight Management fi hdan id-Dipartiment tax-Xjenzi Klinici u Nutrizzjoni ta' l-Universita ta' Chester. L-istudju qed jigi organizzat minn Doreen Micallef, studenta ta' l-MSc taht id-direzzjoni tad-dipartiment.

Lil min ghandi nikkuntatja ghal aktar informazzjoni?

Jekk tixtieq aktar informazzjoni dwar ir-ricerka qabel ma tiddeciedi jekk it-tifla/tifel tieghek tiehux/jiehux sehem fl-istudju, inti mitlub tikkuntattja lil:

Doreen Micallef. 1323313@chester.ac.uk.

Grazzi ta' l-interess tieghek f'din ir-ricerka.

APPENDIX 6 – PARTICIPANT CONSENT FORM IN ENGLISH

Title of Project: Assessment of causes of childhood obesity in 11 year-old Maltese children

Name of Researcher: Doreen Micallef

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my daughter's/son's participation is voluntary and that I am free to withdraw my daughter/son at any time, without giving any reason and without my or my daughter's/son's legal rights being affected. ☐

3. I agree to allow my daughter/son to take part in the above study. ☐

_____	_____	_____
Name of Parent/guardian	Date	Signature
_____	_____	_____
Researcher	Date	Signature

Doreen Micallef 1323313@chester.ac.uk

_____

Supervisor
Prof Stephen Fallows s.fallows@chester.ac.uk

Student number _____
1 for participant; 1 for researcher

APPENDIX 7 - PARTICIPANT CONSENT FORM IN MALTESE

Titlu tal-progett: Studju dwar il- fatturi li jikkawzaw l-obezita' fi tfal Maltin ta' hdax il-sena

Isem ir-ricerkatrici: Doreen Micallef

Jekk joghgbok

immarka l-kaxex

1. Jiena nikkonferma li qrajt u fhimt id-dokument ta' l-informazzjoni dwar l-istudju hawn fuq imsemmi u li kelli l-opportunita' naghmel domandi ☐

2. Nifhem li l-partecipazzjoni tat-tifla/tifel tieghi hija volontarja u li ghandi l-ghazla li nirtira l-partecipazzjoni tat-tifla/tifel tieghi meta irrid, minghajr ma jkolli naghti raguni u li d-drittijiet legali tieghi jew tat-tifla/tifel tieghi ma jigux affettwati. ☐

3. Naghti kunsens biex t-tifla/tifel tieghi tiehu/jiehu sehem f'dan l-istudju hawn fuq imsemmi. ☐

_____	_____	_____
Isem il-genitur/'guardian'	Data	Firma
_____	_____	_____
Ricerkatrici	Data	Firma

Doreen Micallef 1323313@chester.ac.uk

_____

Supervisor

Prof Stephen Fallows s.fallows@chester.ac.uk

Student number _____ 1 ghal partecipant; 1 ghar-ricerkatrici

APPENDIX 8 – LETTER OF INVITATION IN ENGLISH

58, Kent Str.,

Fgura FGR 1555

4th January 2016

Letter of invitation to participate in an M.Sc. research project

Dear parent/guardian,

I am currently reading for an M.Sc. in Weight Management at the University of Chester, UK and as part of my studies, my final research project will be focusing on childhood obesity in Malta and whether certain factors which predispose to this condition in children in other countries are also contributing to the high prevalence of obesity in children in our country. For this reason, I will be coming round to your child's school and measuring his/her BMI and also distributing a questionnaire on the topic which should only take about 15 minutes of your child's time to fill in. Your child's identity will remain unknown through the course of the study and in any subsequent publications of this research.

The participation of your child is strictly on a voluntary basis and is up to you to decide; you may opt out of participation by asking that your child does not complete the questionnaire and does not have his/her BMI taken.

You will find an information sheet attached to this letter, which explains what the questionnaire will be dealing with, together with a consent form which you need to fill in and sign.

Whilst thanking you for taking the time to read this letter, I hope that you will opt to allow your son/daughter to participate in this study.

Regards

Doreen Micallef

email: 1323313@chester.ac.uk

APPENDIX 9 - LETTER OF INVITATION IN MALTESE

58, Kent Str.,

Fgura FGR 1555

4 ta' Jannar 2016

Ittra ta' stedina ghal partecipazzjoni f'progett ta' ricerka ghal 'Masters' fix-xjenza

Ghaziz/a genitur/persuna responsabbli,

Bhalissa jiena qedgha nistudja ghal 'Masters' fix-Xjenza f'Weight Management ma' l-Universita' ta' Chester, l-Ingilterra u bhala parti mill-istudji tieghi, il-progett finali tar-ricerka ser ikun iffukat fuq l-obezita' fit-tfal Maltin u jekk certa fatturi li jwasslu ghal din il-kundizzjoni fi tfal f'pajjizi ohra humiex ukoll jkawzaw ir-rata gholja ta' obezita' fit-tfal taghna. Ghal din ir-raguni, jiena ser inzur l-iskola tat-tifel/tifla tieghek u sejra nkejjel il-BMI tieghu/taghha u ser ukoll inqassam kwestjonarju fuq dan is-suggett li m'ghandux jiehu aktar minn 15 il-minuta biex timtela mit-tifel/tifla tieghek. L-identita' tat-tifel/tifla tieghek tibqa' mistura matul il-kors ta' l-istudju u f'kull publikazzjoni ta' din ir-ricerka.

Il-partecipazzjoni tat-tifel/tifla tieghek hija strettament fuq bazi volontarja u d-decizzjoni hija f'idejk; tista' tiddecidi li t-tifel/tifla tieghek ma jiehux/tiehux sehem u ma jirrispondix/tirrispondix il-kwestjonarju u l-BMI tieghu/taghha ma jittiehidx.

Mehmuza ma' din l-ittra ghandek issib aktar informazzjoni li tispjega aktar dwar x'hiex jikkoncerna dan il-kwestjonarju kif ukoll formola ta' kunsens biex tigi mimlija w iffirmata minnek.

Waqt li nirringrazzjak talli hadt il-hin biex taqra din l-ittra, nispera li inti taghzel li thalli lit-tifel/tifla tieghek jippartecipa/tippartecipa f'dan l-istudju.

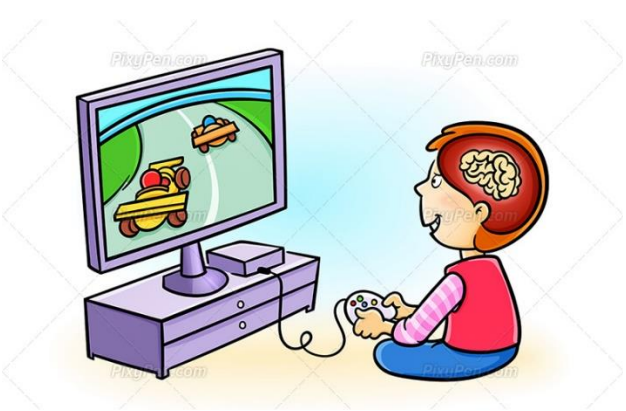
Ghoddi dejjem tieghek,

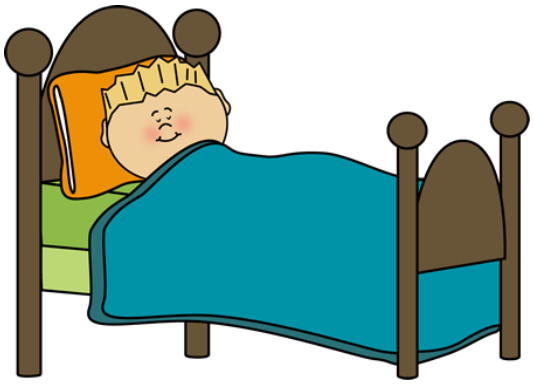
Doreen Micallef

email: 1323313@chester.ac.uk

APPENDIX 10 – VALIDATED QUESTIONNAIRE IN ENGLISH

Questionnaire





Hi kids! In the next 15 minutes, I will be guiding you to fill in this questionnaire on activity, playing video games, soft drinks and sleep. For each question, please tick ***only one response***. If you are unsure of any question, please do not hesitate to ask me or your teacher before you enter your response.

Physical activity

We are trying to find out about your level of physical activity from ***the last 7 days*** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like skipping, running, climbing and others. There are no right or wrong answers – this is not a test. Please answer all the questions as honestly and accurately as you can – this is very important.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one box per row).

	No	1-2	3-4	5-6	7 times or more
Skipping	☐	☐	☐	☐	☐
Walking for exercise	☐	☐	☐	☐	☐
Cycling	☐	☐	☐	☐	☐
Jogging/running	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Dance	☐	☐	☐	☐	☐
Football	☐	☐	☐	☐	☐
Basketball	☐	☐	☐	☐	☐
Other: _____	☐	☐	☐	☐	☐

2. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Mark one only)

I don't do PE ☐

Hardly ever ☐

Sometimes ☐

Quite often ☐

Always ☐

3. In the last 7 days, what did you do most of the time *at recess*? (Mark one only)

Sat down (talking, reading, doing schoolwork) ☐

Stood around or walked around ☐

Ran or played a little bit ☐

Ran around and played quite a bit ☐

Ran and played hard most of the time ☐

4. In the last 7 days, what did you do normally *at lunchtime* (besides eating lunch)? (Mark one only)

Sat down (talking, reading, doing schoolwork) ☐

Stood around or walked around ☐

Ran or played a little bit ☐

Ran around and played quite a bit ☐

Ran and played hard most of the time ☐

5. In the last 7 days, on how many days *right after school,* did you do sports, dance or play games in which you were very active? (Mark one only)

None

1 time last week

2 or 3 times last week

4 times last week

5 times last week

6. In the last 7 days, on how many *evenings,* did you do sports, dance or play games in which you were very active? (Mark one only)

None

1 time last week

2 or 3 times last week

4 times last week

5 times last week

7. *On the last weekend*, on how many times did you do sports, dance or play games in which you were very active? (Mark one only)

None

1 time last week

2 or 3 times last week

4 times last week

5 times last week

8. Mark how often you did physical activity (like playing sports, games, dancing or any other physical activity) for each day last week.

	None	Little	Medium	Often	Very often
Monday	☐	☐	☐	☐	☐
Tuesday	☐	☐	☐	☐	☐
Wednesday	☐	☐	☐	☐	☐
Thursday	☐	☐	☐	☐	☐
Friday	☐	☐	☐	☐	☐
Saturday	☐	☐	☐	☐	☐
Sunday	☐	☐	☐	☐	☐

9. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Mark only one)

Yes ☐

No ☐

Screen time

10. Think about a normal *school week*, and write down how long (hours and minutes) you spend doing the following activities before and after school each day.

	Mon	Tues	Wed	Thurs	Fri
Watching TV					
Watching DVDs					
Using the computer for fun					
Using the computer to do homework					
Playing video games					

11. Think about a *normal weekend,* and write down how long you spend doing the following activities in the weekend.

	Sat	Sun
Watching TV		
Watching DVDs		
Using the computer for fun		
Using the computer to do homework		
Playing video games		

Beverages consumption

12. In the past 7 days, how often did you drink the following beverages and approximately how much did you drink *each time?*

	How often (mark 1)							How much each time (mark 1)				
Type of beverage	Never	once a week	2-3 a wk	4-6/wk	1/day	2-3/day	>3/day	<1 glass	1 glass	1.5 glass	2 glasses	>2 glasses
Water												
Fruit juice												
Regular soft drinks												
Diet soft drinks												
Milk												
Other												

Sleep

The following questions are related to your bedtime. Choose the most appropriate answer (mark only one).

	Usually	Sometimes	Rarely
13. I go to bed at the same time each night	☐	☐	☐
14. I sleep about the same amount of hours each night	☐	☐	☐

15. On most nights I sleep for:

Less than 8 hours

8 hours

9 hours

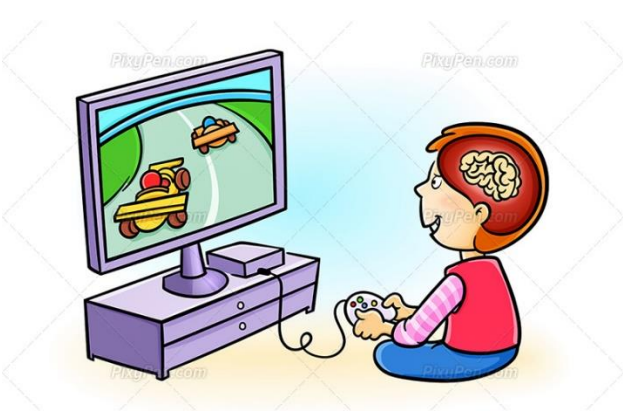
10 hours

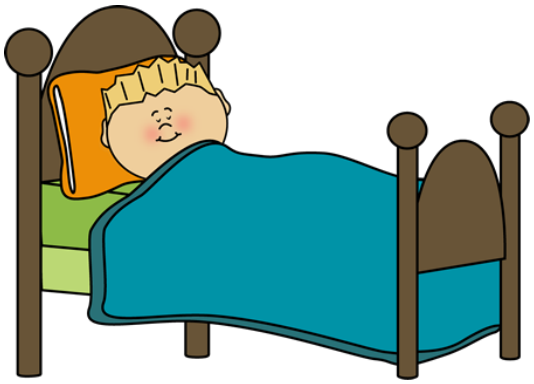
More than 10 hours

Thank you for answering the questionnaire

APPENDIX 11 – VALIDATED QUESTIONNAIRE IN MALTESE

Kwestjonarju





Kif ahna tfal? Fil-15 il-minuta li jmiss, ser nghinkom timlew da nil-kwestjonarju dwar attivita' fizika, loghob ta' 'video games' u bil-kompjuter, xorb ta' luminati u l-irqad. Ghal kull mistoqsija, qis li timmarka ***risposta wahda biss.*** Jekk m'intix cert/a dwar xi mistoqsija, tiddejjaqx tistaqsi lili jew lit-'teacher' qabel ma timla' r-risposta tieghek.

Attivita' fizika

Qedghin nippruvaw nkunu nafu aktar dwar il-livell ta' attivita' fizika tieghek ***f'dawn l-ahhar sebat ijiem***. Dan jinkludi sports jew skin li jgelghek tghereq jew thoss saqajk jghejjew, jew loghob li jgelghek tiehu nifs qawwi bhal qbiz, giri, jew ohrajn. M'hemmx risposti tajba jew hziena – dan mhux ezami. Jekk jghogbok irrispondi d-domandi kemm jista' jkun onestament u kemm jista' jkun precizi – dan huwa mportanti.

1. Attivita' fizika fil-hin liberu tieghek: hadt sehem f'xi wiehed minn dawn l-attivitajiet f'dawn l-ahhar sebat ijiem? Jekk iva, kemm il-darba? (Immarka kaxxa wahda biss kull ringiela).

	Le	1-2	3-4	5-6	7 darbiet Jew aktar
Qbis	☐	☐	☐	☐	☐
Mixi bhala ezercizju	☐	☐	☐	☐	☐
Uzu ta' rota	☐	☐	☐	☐	☐
Jogging/giri	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐
Ghawm	☐	☐	☐	☐	☐
Zfin	☐	☐	☐	☐	☐
Futbal	☐	☐	☐	☐	☐
Basketball	☐	☐	☐	☐	☐
Ohrajn:	☐	☐	☐	☐	☐

_____

2. Fl-ahhar sebat ijiem, waqt il-lezzjoni ta' l-edukazzjoni fizika, kemm il-darba kont attiv/a hafna (lghabt hafna, grejt, qbist, waddabt xi haga)? (Immarka kaxxa wahda biss)

Ma nghamilx PE ☐

Kwazi qatt ☐

Xi kultant ☐

Hafna drabi ☐

Dejjem ☐

3. Fl-ahhar sebat ijiem, x'inhi l-aktar haga li ghamilt *waqt il-brejk*? (Immarka wahda biss)

Qadt bilqedgha (nitkellem, naqra, naghmel xoghol) ☐

Qadt bilwieqfa jew imxejt ☐

Grejt jew lghabt ftit ☐

Grejt jew lghabt mhux hazin ☐

Grejt jew lghabt hafna partita mill-hin ☐

4. FL-ahhar sebat ijiem, x'ghamilt normalment *waqt il-hin ta' l-ikel* (barra li qadt tiekol)? (Immarka wahda biss)

Qadt bilqedgha (nitkellem, naqra, naghmel xoghol) ☐

Qadt bilwieqfa jew imxejt ☐

Grejt jew lghabt ftit ☐

Grejt jew lghabt mhux hazin ☐

Grejt jew lghabt hafna partita mill-hin ☐

5. Fl-ahhar sebat ijiem, kemm il-darba *ezatt wara l-iskola*, ghamilt xi sport, zfint jew lghabt xi loghob li gghelghek tkun attiv/a hafna? (Immarka wahda biss)

Qatt

Darba fl-ahhar gimgha

2 or 3 darbiet fl-ahhar gimgha

4 darbiet fl-ahhar gimgha

5 darbiet fl-ahhar gimgha

6. FL-ahhar sebat ijiem, kemm il-darba *fil-ghaxija*, ghamilt xi sport, zfint jew lghabt xi loghob li gghelghek tkun attiv/a hafna? (Immarka wahda biss)

Qatt

Darba fl-ahhar gimgha

2 or 3 darbiet fl-ahhar gimgha

4 darbiet fl-ahhar gimgha

5 darbiet fl-ahhar gimgha

7. *Fil-'weekend' li ghadda*, kemm il-darba ghamilt xi sport, zfint jew lghabt xi loghob li gghelghek tkun attiv/a hafna? (Immarka wahda biss)

Qatt

Darba fl-ahhar gimgha

2 or 3 darbiet fl-ahhar gimgha

4 darbiet fl-ahhar gimgha

5 darbiet fl-ahhar gimgha

8. Immarka kemm il-darba ghamilt xi attivita' fizika (bhal xi sport, loghob, zfin jew attivita' fizika ohra) ghal kull gurnata tal-gimgha li ghaddiet.

	Xejn	Ftit	mhux hafna	ta' spiss	Hafna
It-Tnejn	☐	☐	☐	☐	☐
It-Tlieta	☐	☐	☐	☐	☐
L-Erbgha	☐	☐	☐	☐	☐
Il-Hamis	☐	☐	☐	☐	☐
Il-Gimgha	☐	☐	☐	☐	☐
Is-Sibt	☐	☐	☐	☐	☐
Il-Hadd	☐	☐	☐	☐	☐

9. Kont ma tiflahx il-gimgha li ghaddiet jew ghal xi raguni jew ohra ma stajtx taghmel l-attivitajiet fizici normali tieghek? (Immarka wahda biss)

Iva ☐

Le ☐

Hin quddiem 'screen'

10. Ahseb dwar gimgha normali *waqt l-iskola*, u ikteb kemm tqatta hin (sieghat u minuti) taghmel dawn l-affarijiet imsemmija hawn taht qabel u wara l-iskola kuljum.

	Tnejn	Tlieta	Erbgha	Hamis	Gimgha
Tara t-televixin					
Tara DVDs					
Tuza l-kompjuter ghal pjacir					
Tuza l-kompjuter ghal homework					
Tilghab 'video games'					

11. Ahseb dwar tmiem il-gimgha normali, u ikteb kemm tqatta hin (sieghat u minuti) taghmel dawn l-affarijiet imsemmija hawn taht fi tmiem il-gimgha.

	Sibt	Hadd
Tara t-televixin		
Tara DVDs		
Tuza l-kompjuter ghal pjacir		
Tuza l-kompjuter ghal homework		
Tilghab 'video games'		

Konsum ta' xorb

12. Fl-ahhar sebat ijiem, kemm il-darba xrobt minn dawn ix-xorb imsemmi hawn that u xi kemm xrobt *kull darba?*

		Kemm il-darba (immarka wahda)						Kemm xrobt kull darba (immarka wahda)				
	Qatt	Darba	2 jew 3	4 sa 6	darba	2 jew 3	iktar	Inqas	tazza	tazza u	zewg	aktar minn
		fil	fil	fil	kuljum	kuljum	minn 3	minn	wahda	nofs	tazez	zewg
Tip ta' xorb		gimgha	gimgha	gimgha			kuljum	tazza				tazez
Ilma												
Fruit juice												
Luminati												
Luminati diet												
Halib												
Ohrajn												

Irqad

Il-mistoqsijiet li jmiss ghandhom x'jaqsmu mal-hin ta' l-irqad taghkom. Ghazel l-ahjar twegiba (immarka wahda biss).

	Dejjem	Xi kultant	Qatt
13. Immur norqod fl-istess hin kull filghaxija	☐	☐	☐
14. Norqod l-istess ammont ta' sieghat kull filghaxija	☐	☐	☐

15. Kwazi rull filghaxija norqod:

Inqas minn 8 sieghat ☐

8 sieghat ☐

9 sieghat ☐

10 sieghat ☐

Aktar minn 10 sieghat ☐

Grazzi talli rrispondejt dan il-kwestjonarju

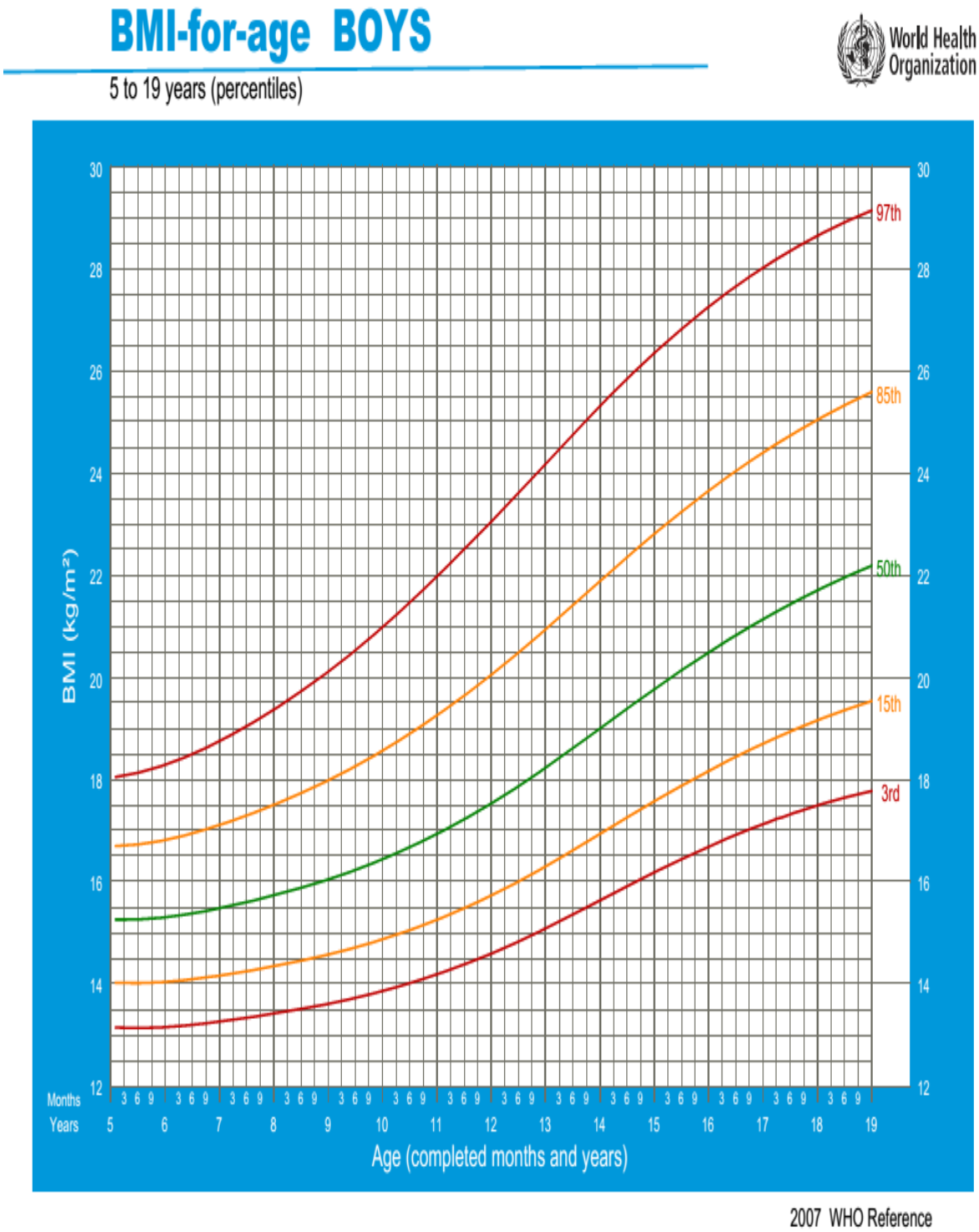
APPENDIX 12 – CDC MANUAL PROTOCOL OF MEASUREMENT OF HEIGHT AND WEIGHT

Please refer to:

http://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/manual_an.pdf

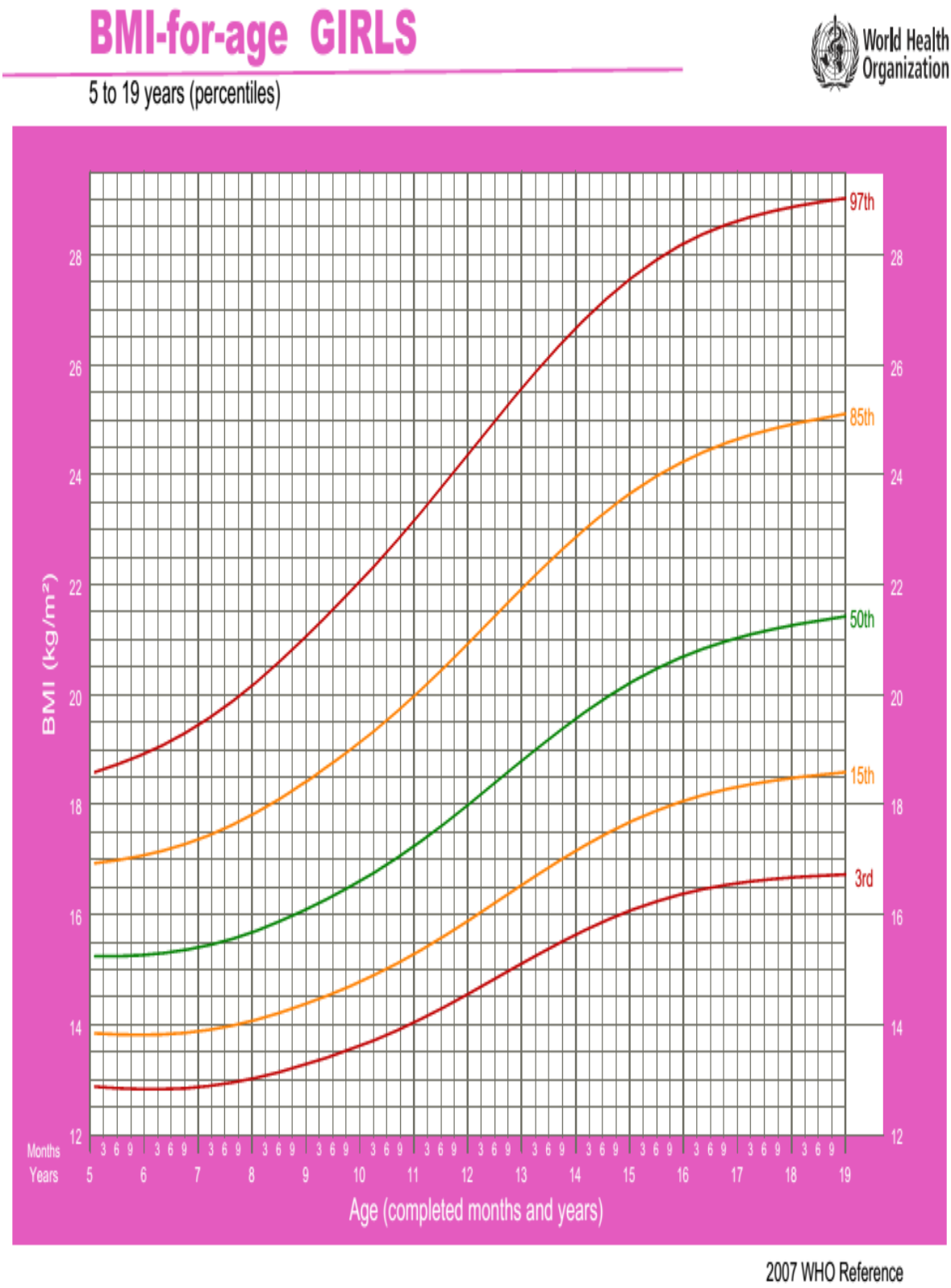
APPENDIX 13 – WHO BMI-FOR-AGE GROWTH CHART BOYS

Figure 1. WHO BMI-for-age growth chart for boys

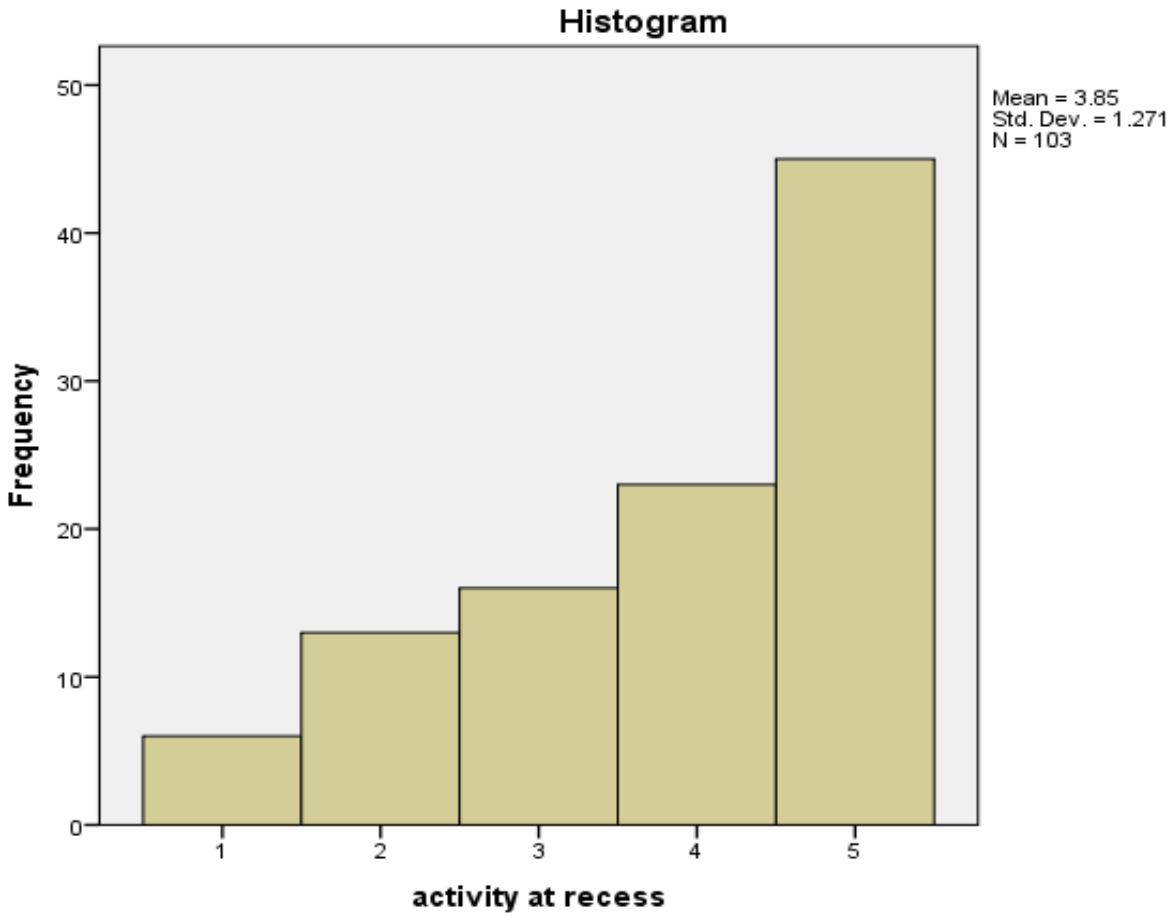


APPENDIX 14 – WHO BMI FOR AGE GROWTH CHART GIRLS

Figure 2. WHO BMI-for-age growth chart for girls



APPENDIX 15 – ACTIVITY DURING RECESS HISTOGRAM



Activity at recess

1 = sat down

2 = stood around or walked around

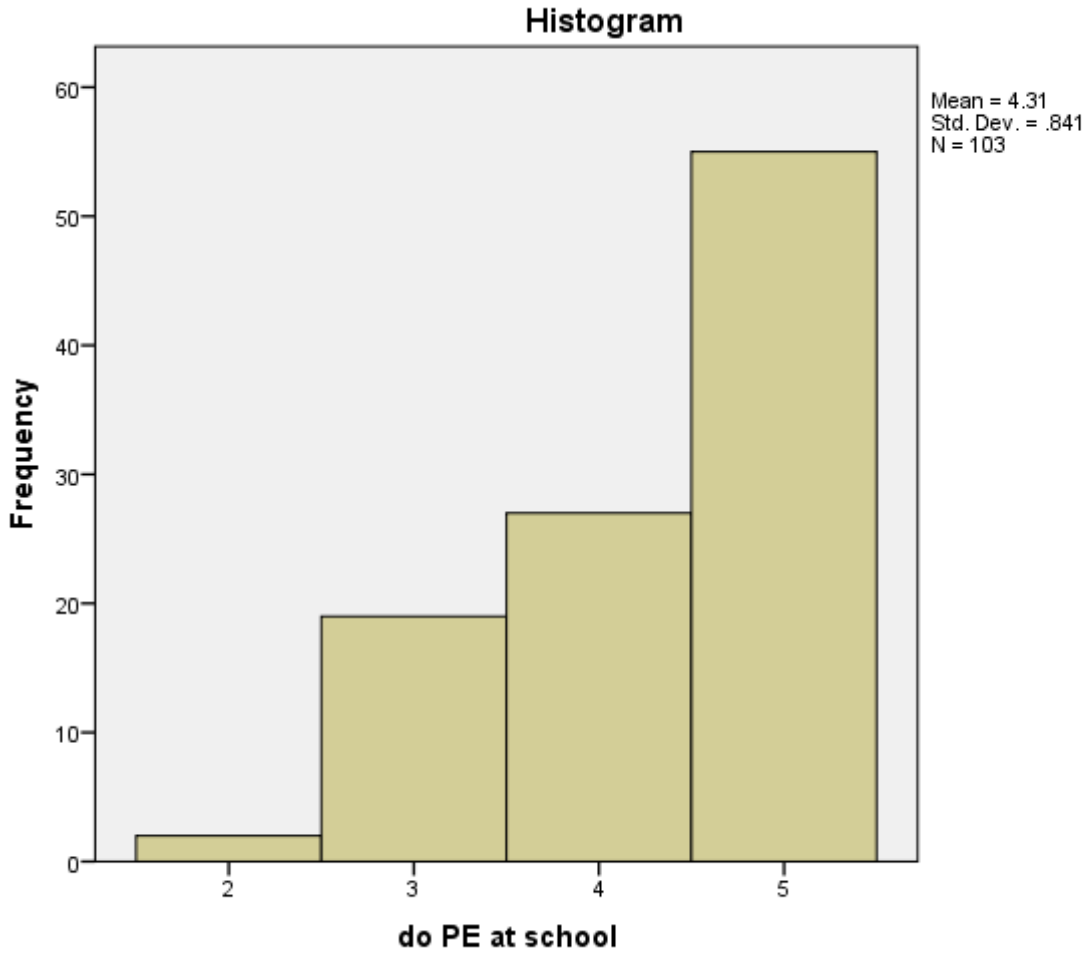
3 = ran or played a little bit

4 = ran around and played quite a bit

5 = ran and played hard most of the time

Figure 3. Graph showing the number of participants and their reported level of activity during recess

APPENDIX 16 – HISTOGRAM OF FREQUENCY OF CARRYING OUT PHYSICAL EDUCATION CLASSES AT SCHOOL



Whether students do physical education or not at school
2 = hardly ever
3 = sometimes
4 = quite often
5 = always

Figure 4. Graph showing the number of participants and whether they do physical education classes at school or not

APPENDIX 17 – GRAPH OF FREQUENCY OF AFTER-HOURS ACTIVITY

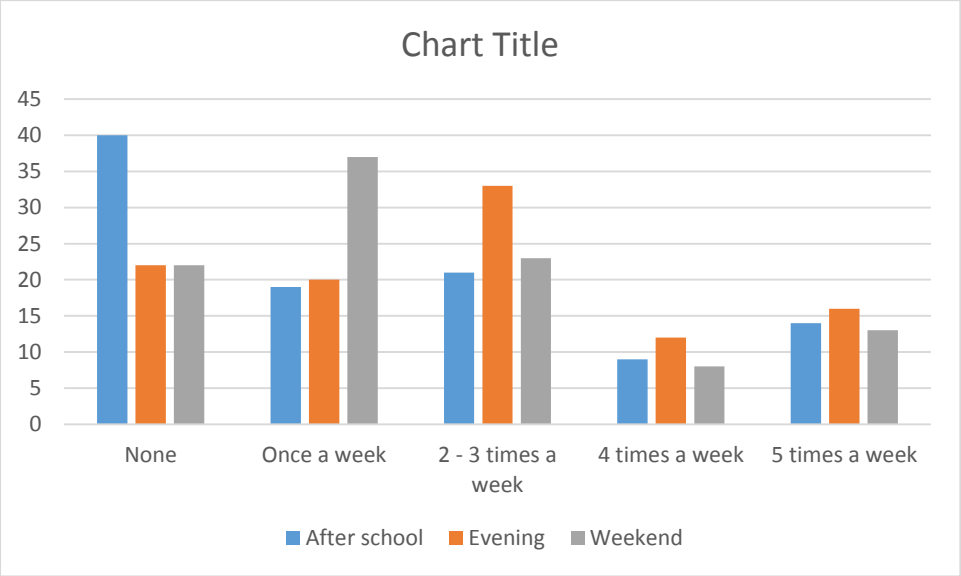


Figure 5. Graph of number of students versus frequency of activity after school, in the evening and on weekends

APPENDIX 18 – GRAPH OF STUDENTS' REPORTED SLEEPING HABITS

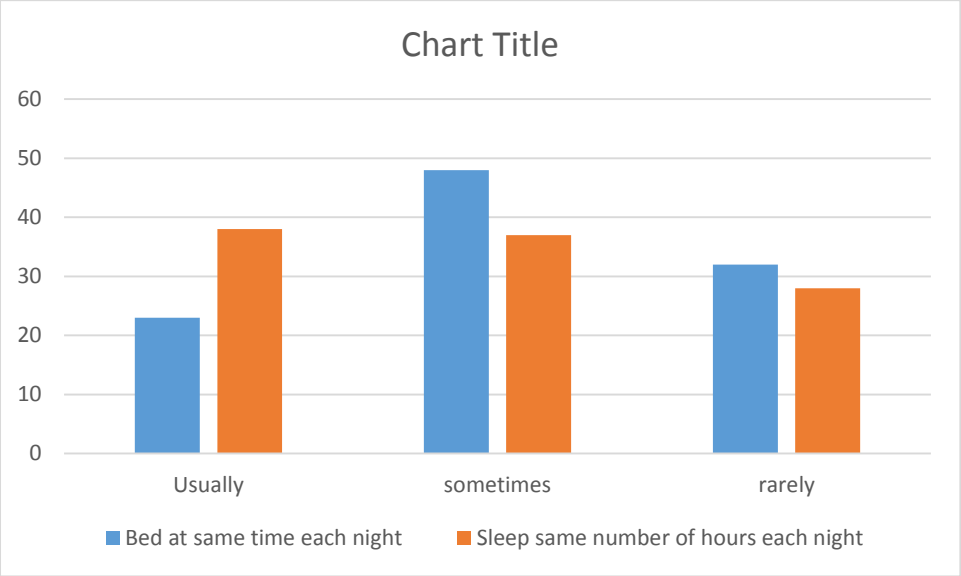


Figure 6. Graph showing students' reported sleeping habits

APPENDIX 19 – DESCRIPTIVE DATA FOR ALL FOUR FACTORS AFFECTING CHILDHOOD OBESITY

Table 6. Descriptive data for physical activity, screen-time, drinks consumption and hours of sleep

Factors investigated	*Mean*	*Standard error*	*SD*	*Minimum*	*Maximum*
number of activities	4.68	0.224	2.276	0	10
average times activities carried out per week	3.62	0.145	1.476	0	7
Number of forms of screen on weekdays	2.60	0.115	1.166	1	5
hours of screen time on weekdays	10.07	0.775	7.861	0.5	32
number of forms of screen on weekends	2.50	0.123	1.251	0	5
hours of screen time on weekends	6.17	0.462	4.687	0	24
weekly water consumption in glasses (250 ml)	25.16	1.482	15.040	0	42
weekly fruit juice consumption in glasses (250 ml)	3.62	0.743	7.538	0	42
weekly non-diet soft drink consumption in glasses (250 ml)	6.22	0.900	9.138	0	42
weekly diet soft drink consumption in glasses (250 ml)	0.49	0.176	1.782	0	14
weekly milk consumption in glasses (250 ml)	9.66	1.126	11.424	0	42
weekly consumption of other drinks in glasses (250 ml)	4.26	0.798	8.099	0	42
average number of hours of sleep nightly	8.41	0.105	1.070	7	11

APPENDIX 20 – DESCRIPTIVE DATA GRAPHS

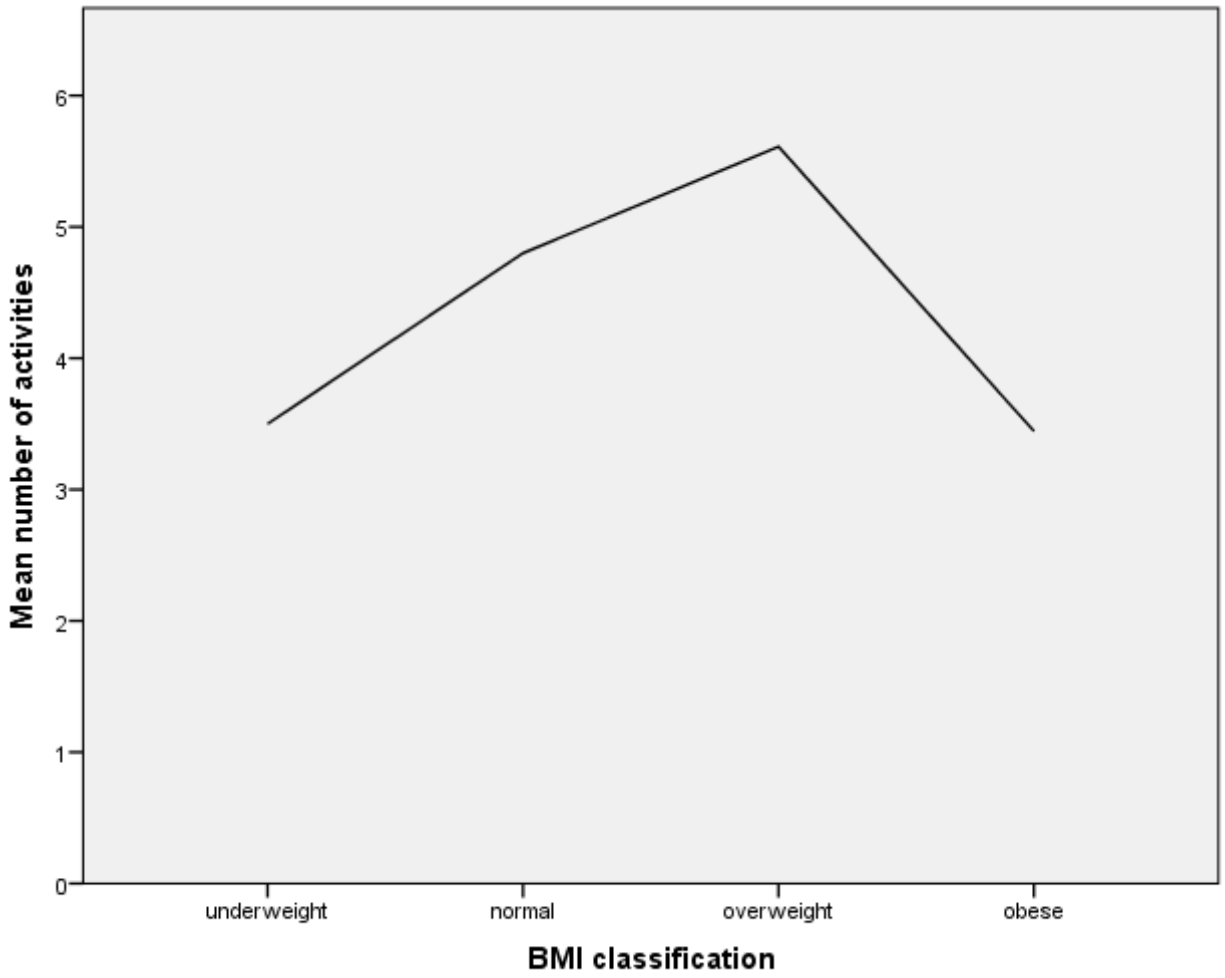


Figure 7. Graph of mean number of different physical activities carried out per week versus BMI classification

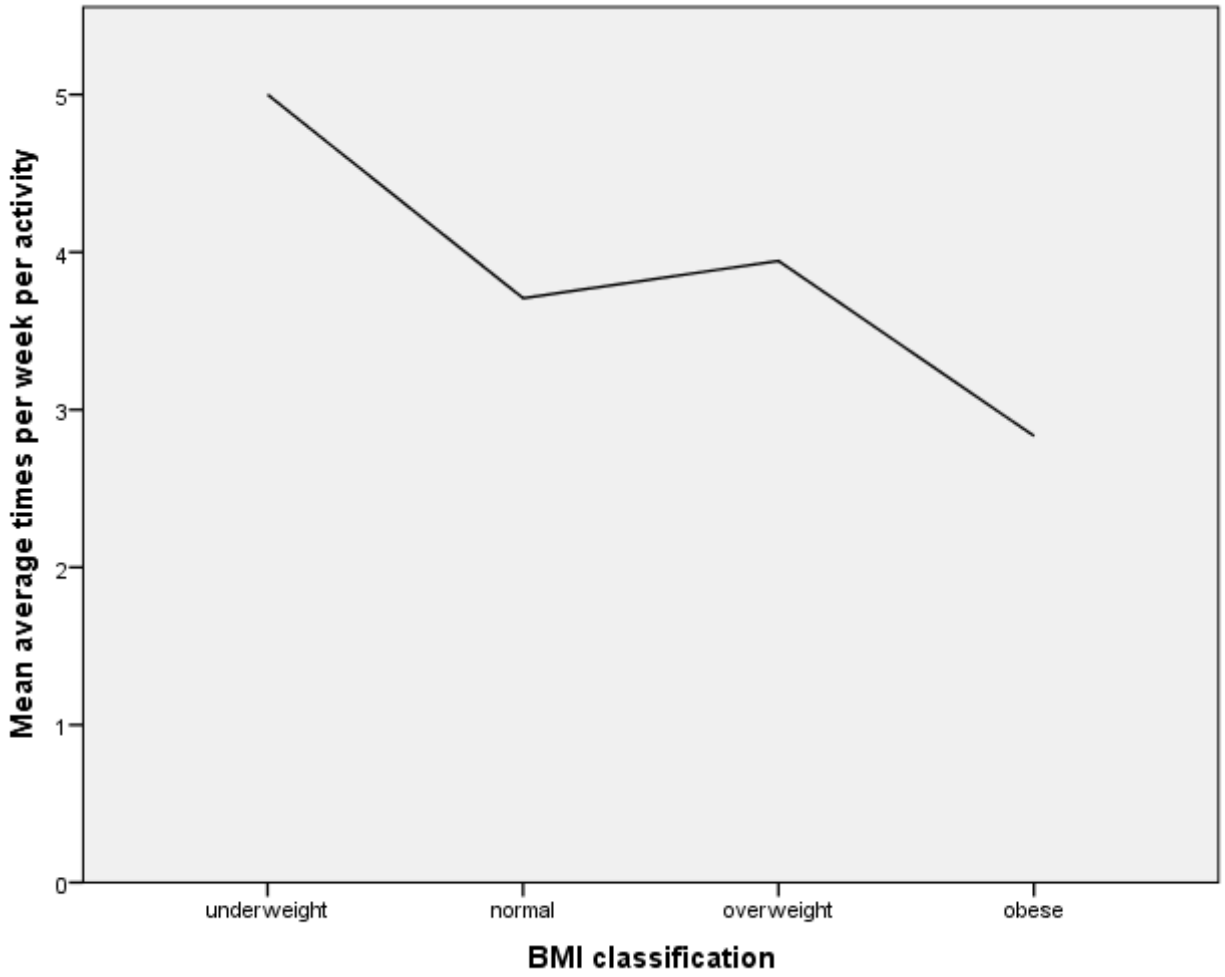


Figure 8. Graph of average number of times respondents carry out each physical activity per week against BMI classification

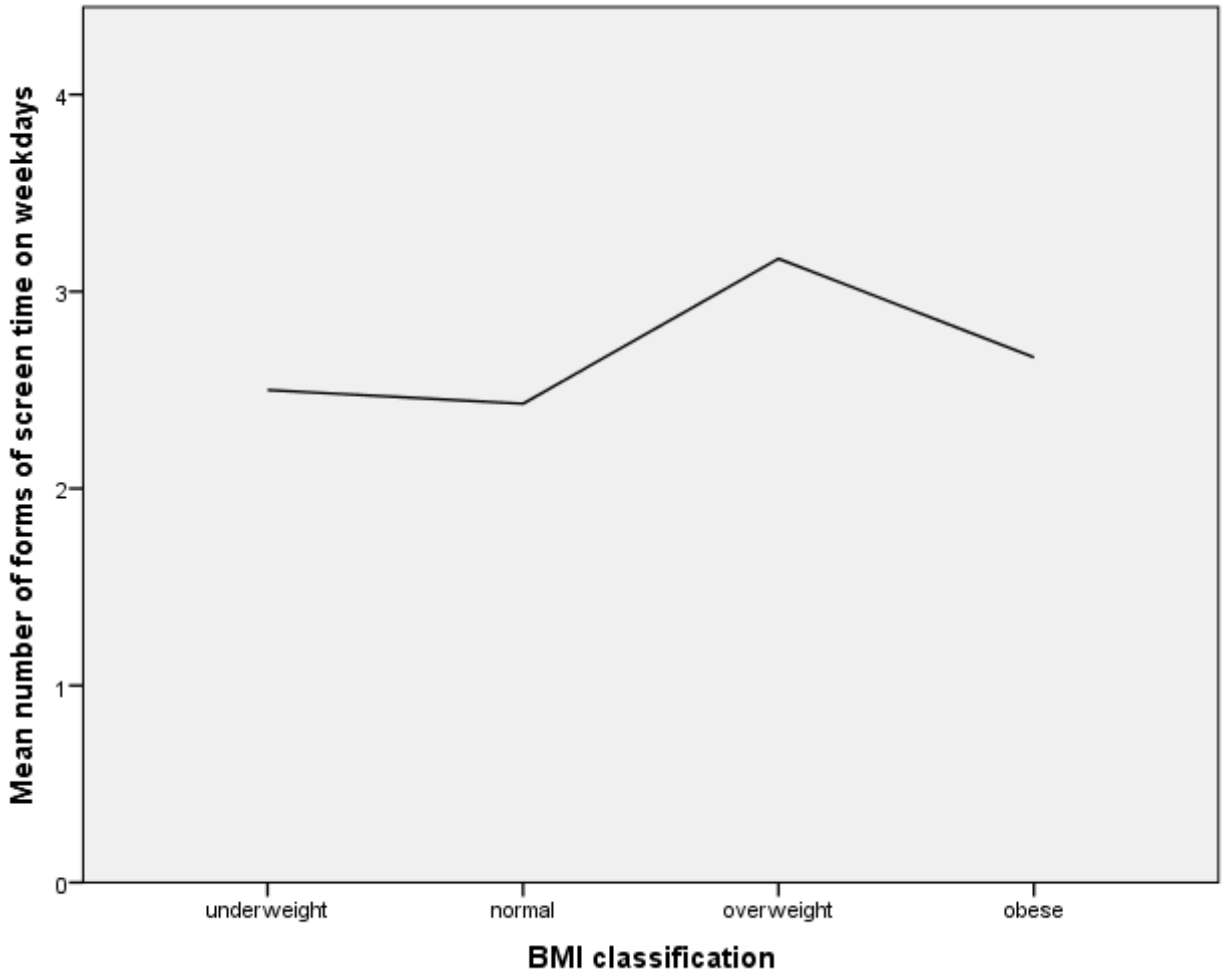


Figure 9. Graph of mean number of forms of screen time utilised by respondents on weekdays against BMI classification

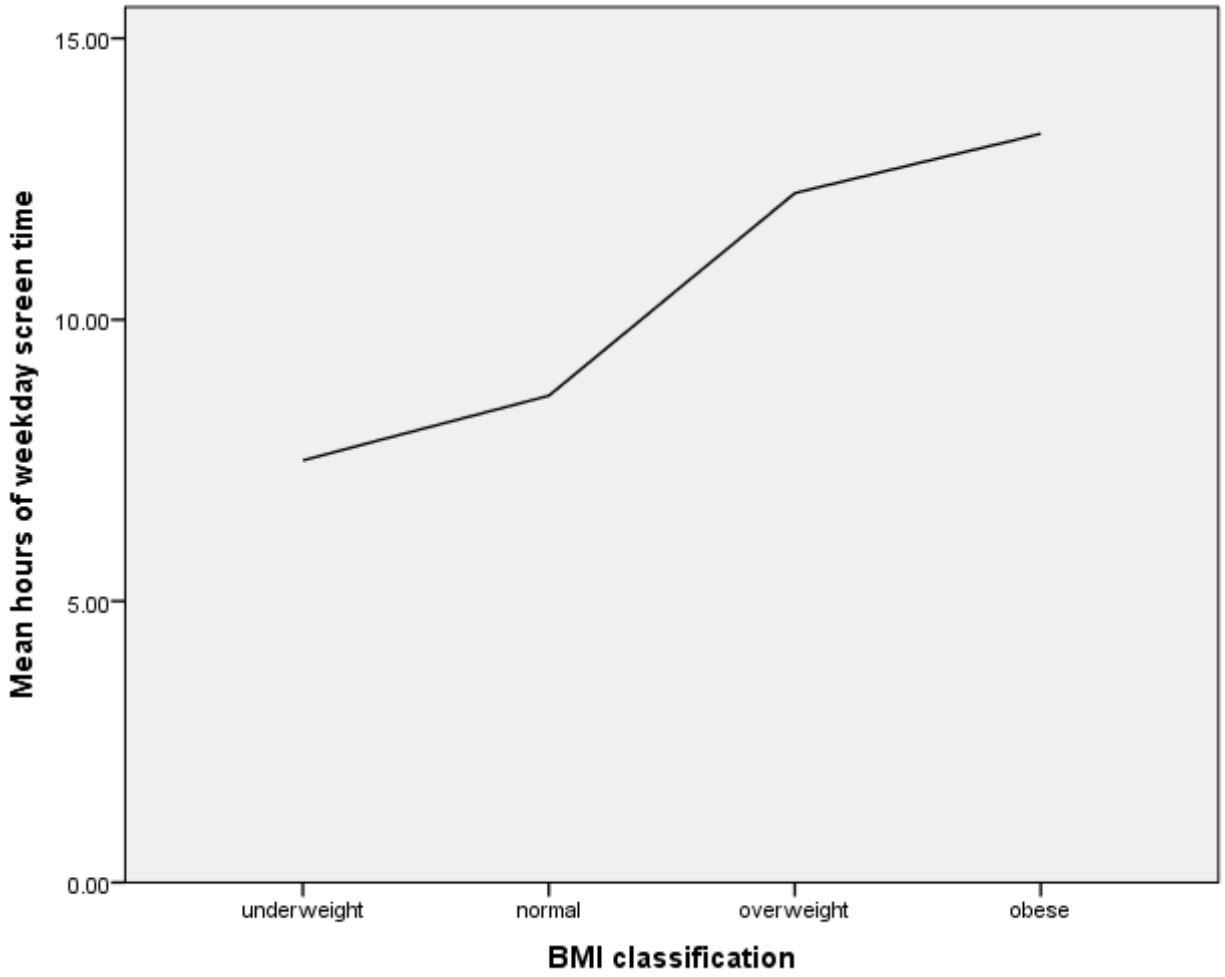


Figure 10. Graph of mean number of hours of screen time viewed on weekdays against BMI classification

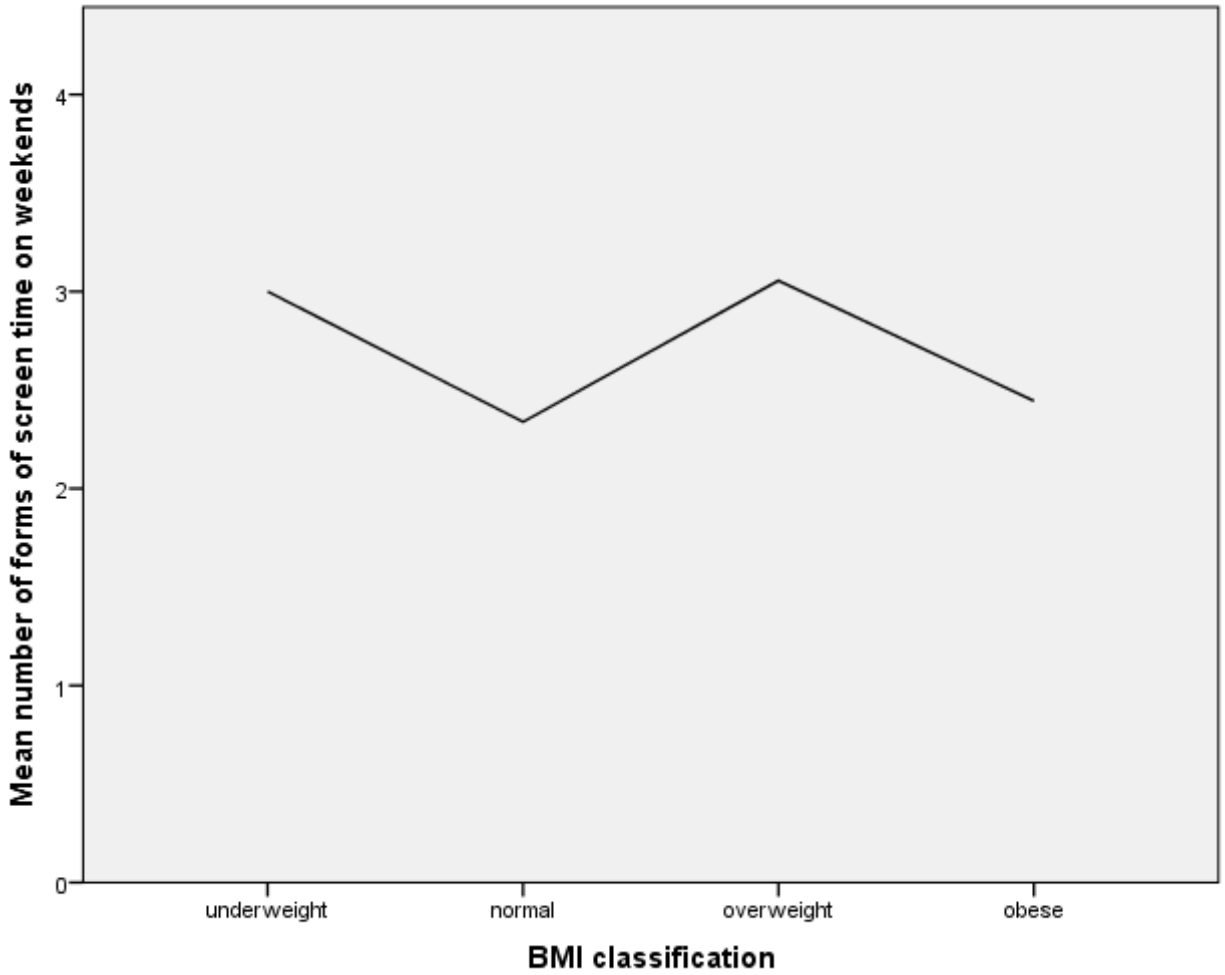


Figure 11. Graph of mean number of forms of screen time utilised by respondents on weekends against BMI classification

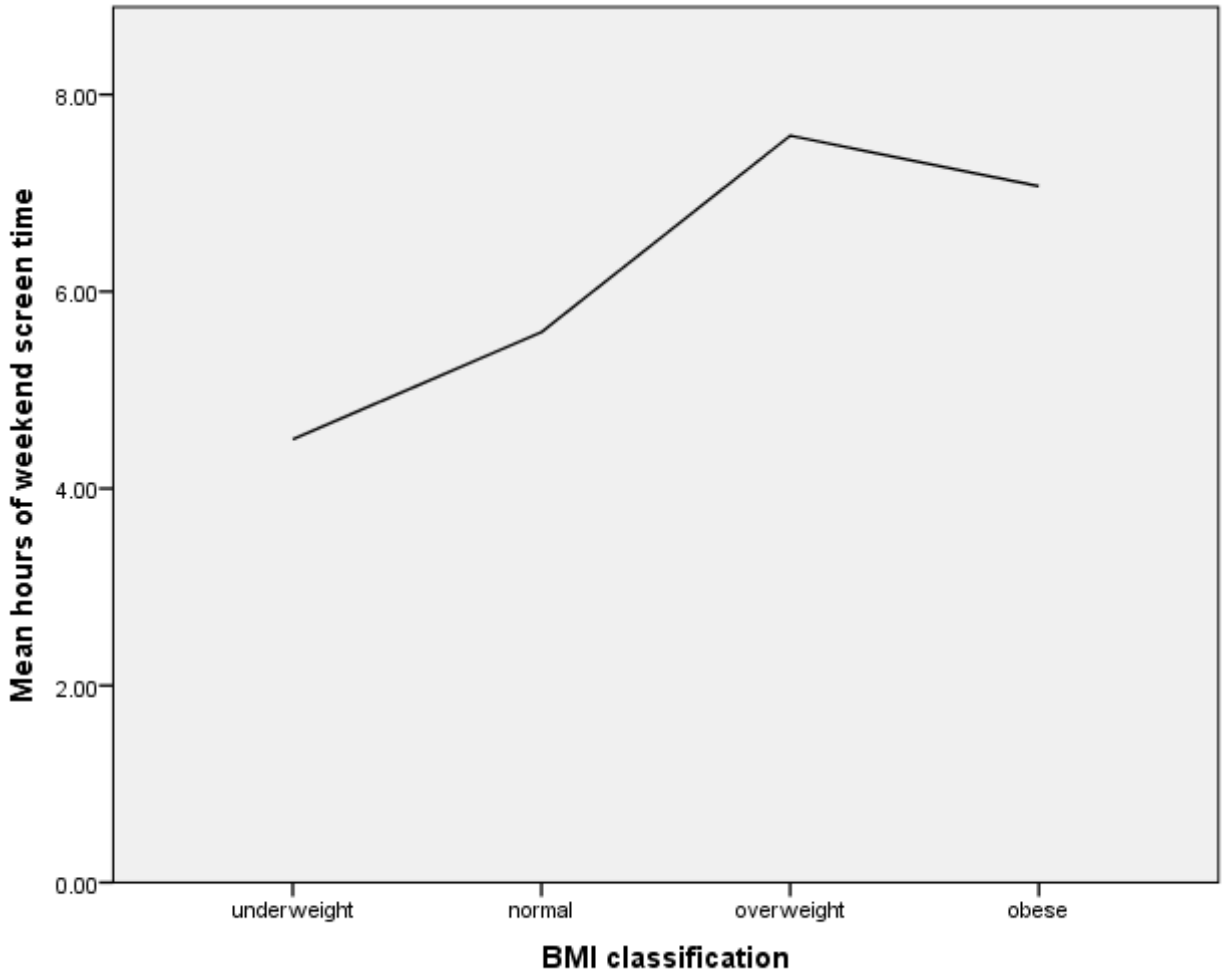


Figure 12. Graph of mean number of hours of screen time on weekends against BMI classification

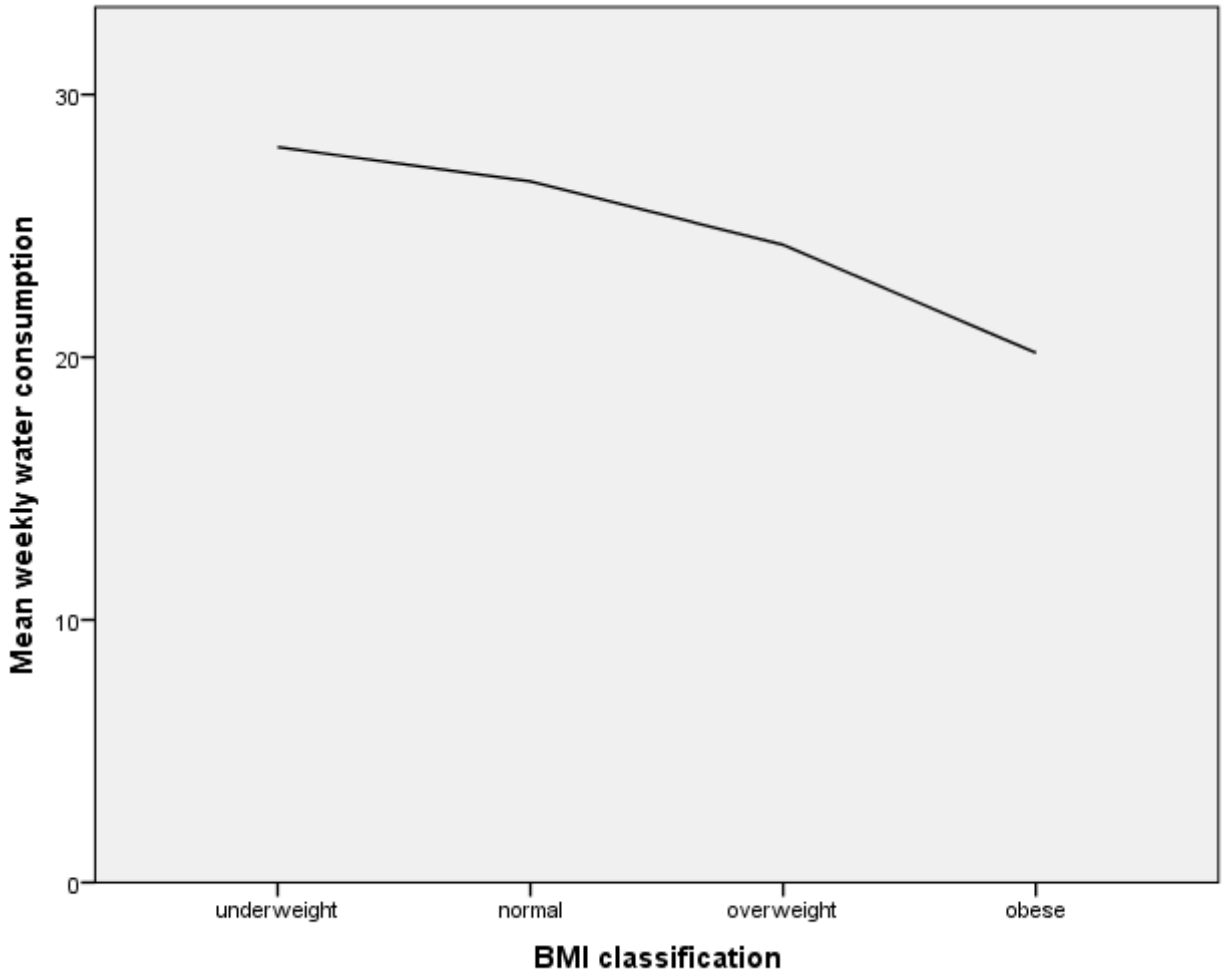


Figure 13. Graph of mean weekly water consumption in glasses against BMI classification

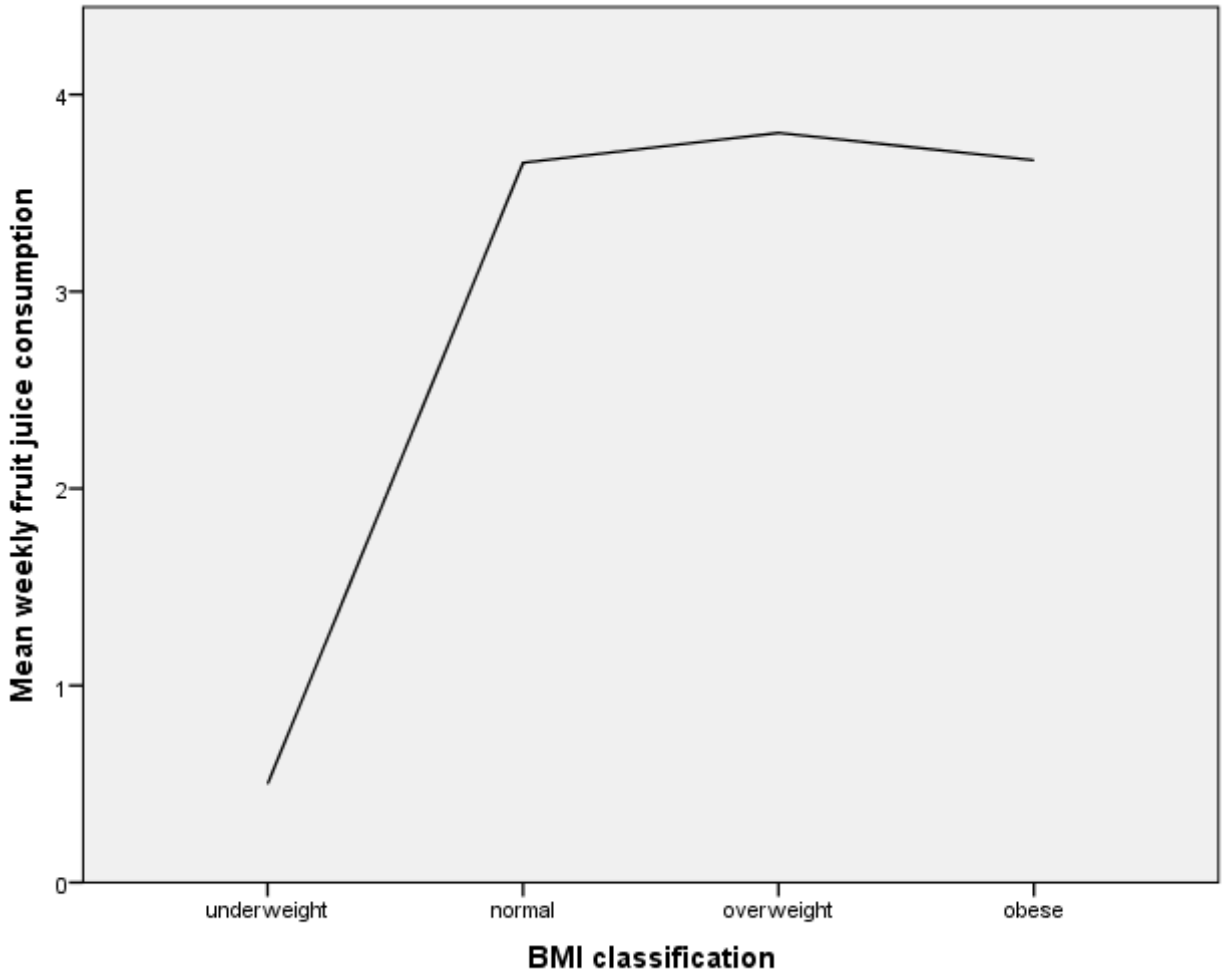


Figure 14. Graph of mean weekly fruit juice consumption in glasses against BMI classification

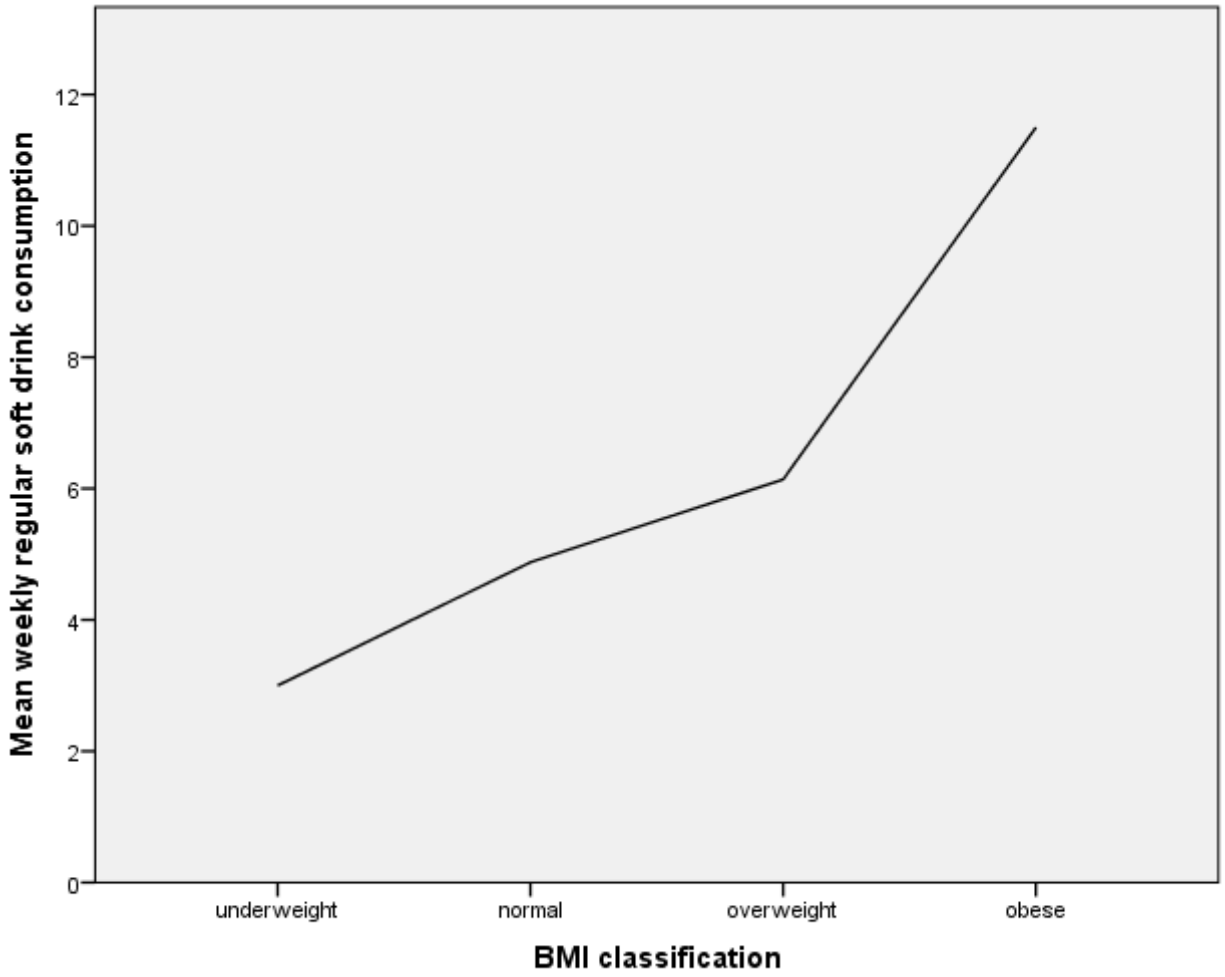


Figure 15. Graph of mean weekly regular soft drink (sugar-sweetened beverages) consumption in glasses against BMI classification

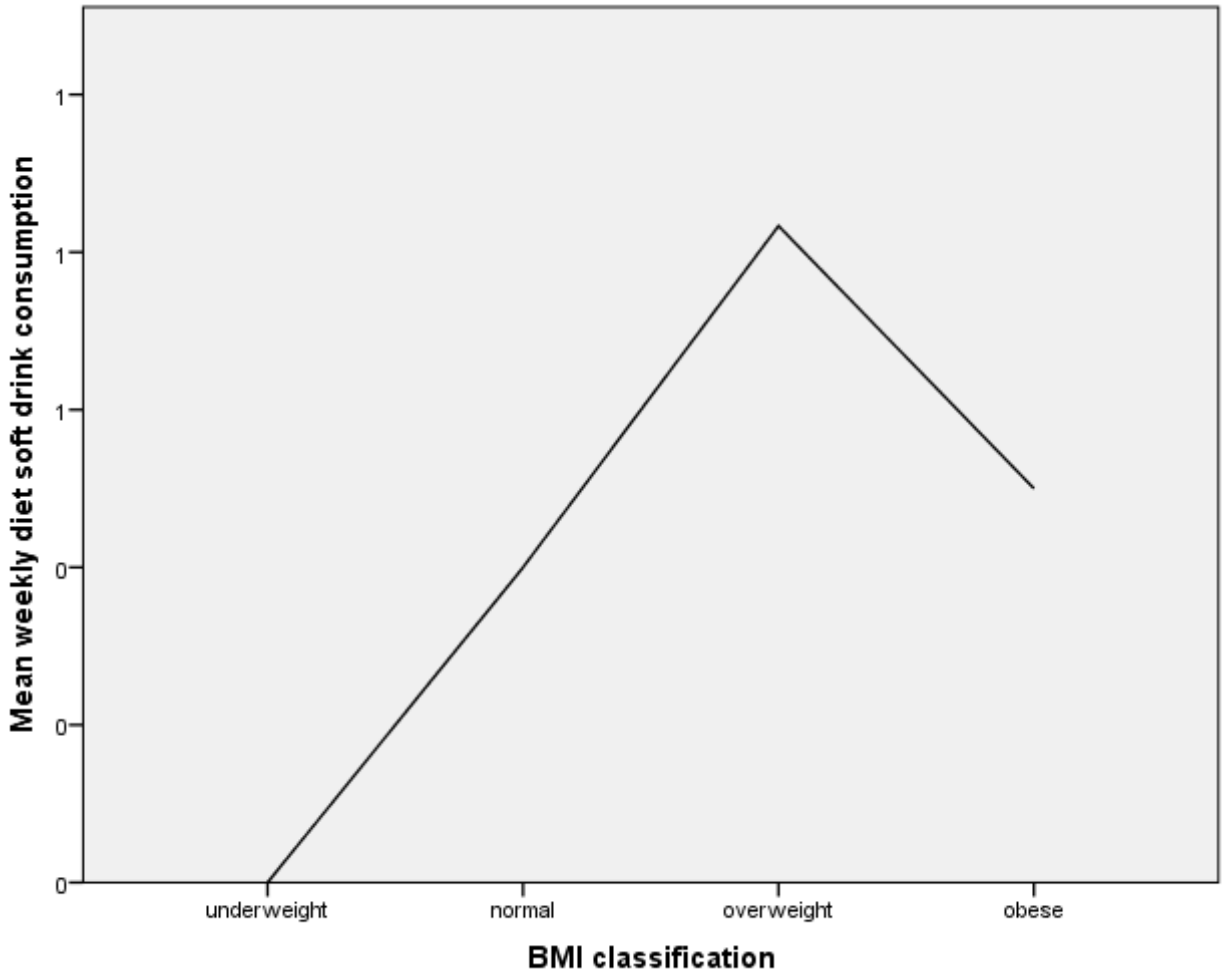


Figure 16. Graph of mean weekly diet soft drink (non-sugar sweetened beverages) consumption in glasses against BMI classification

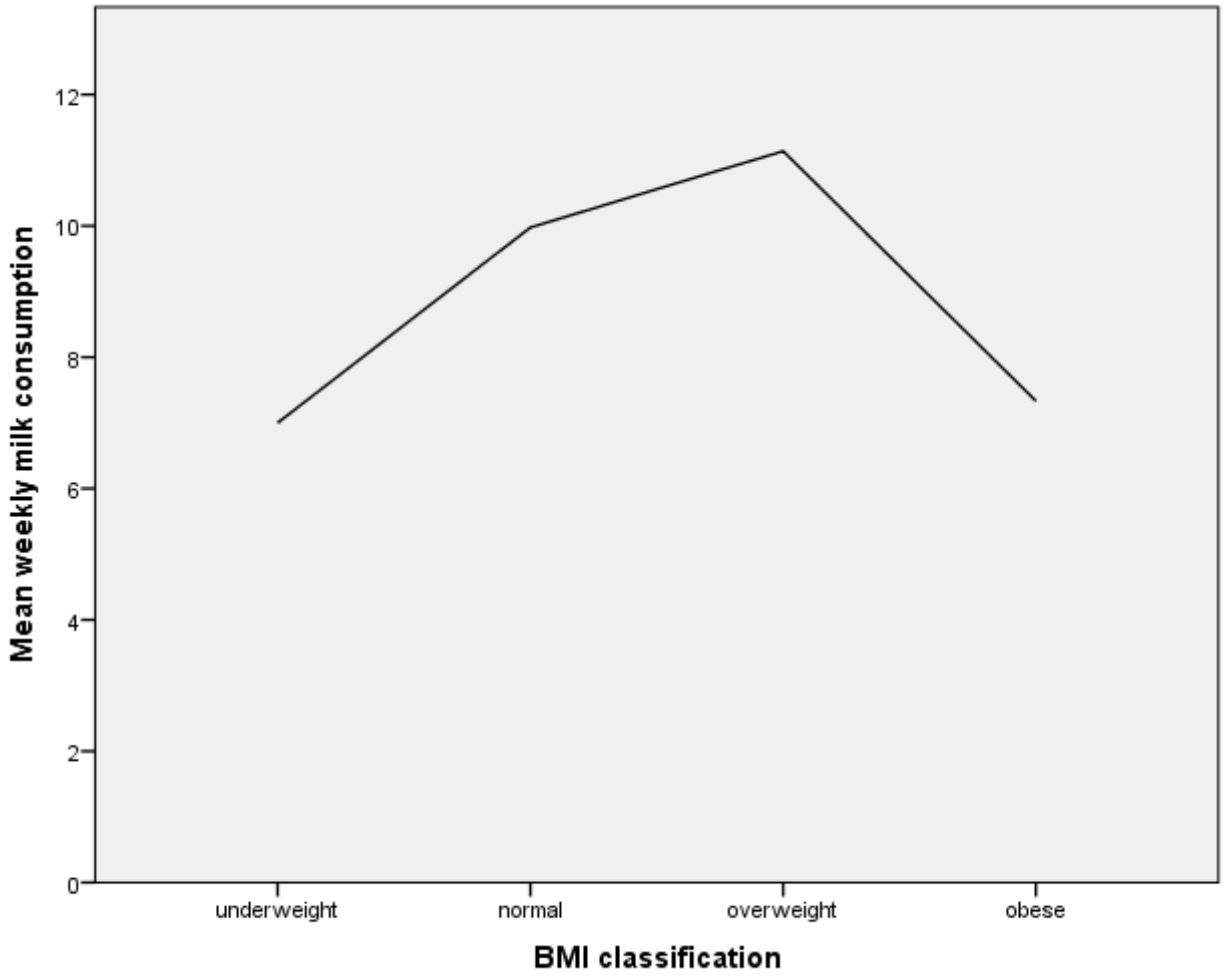


Figure 17. Graph of mean weekly milk consumption in glasses against BMI classification

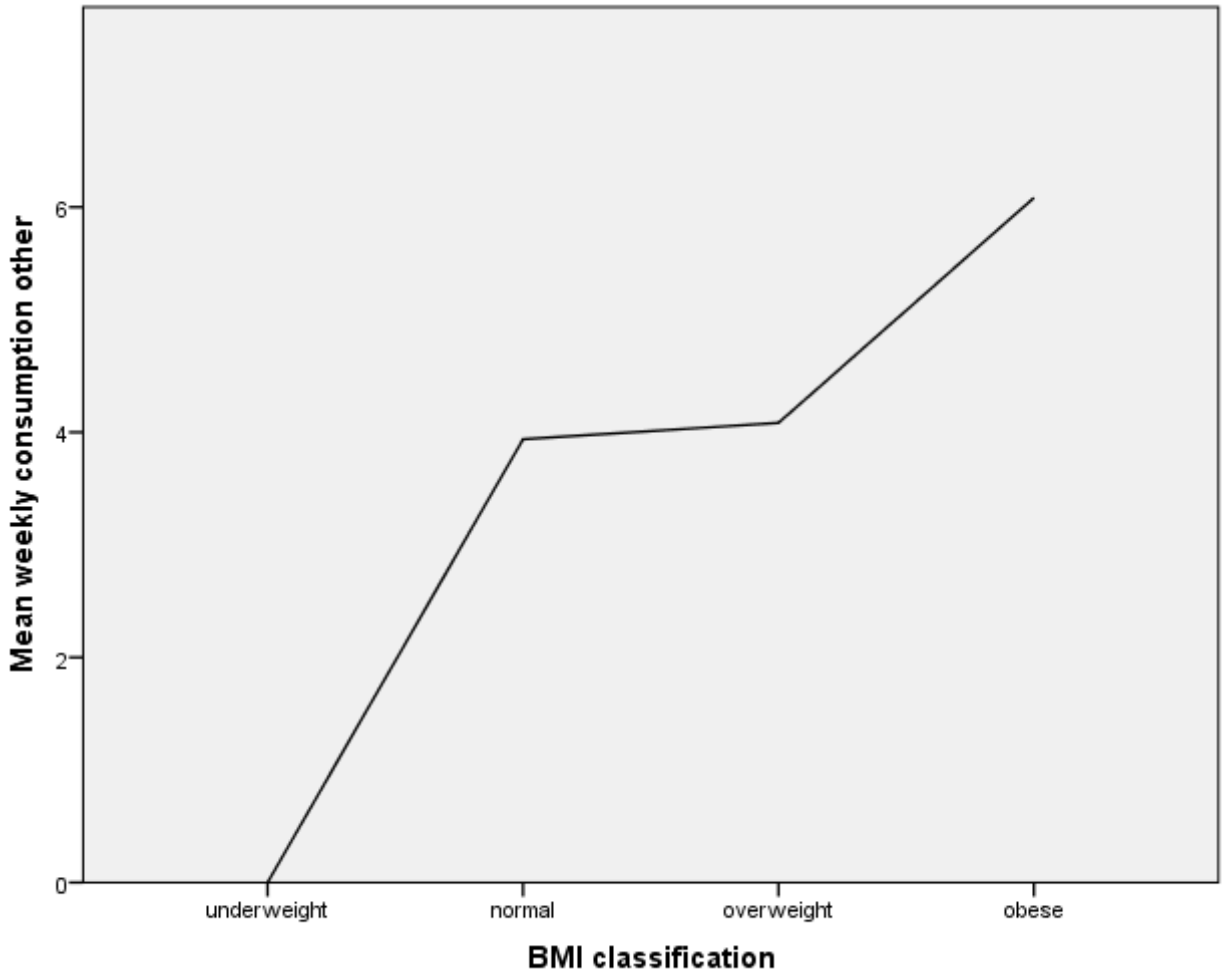


Figure 18. Graph of mean weekly consumption of other forms of beverages in glasses against BMI classification

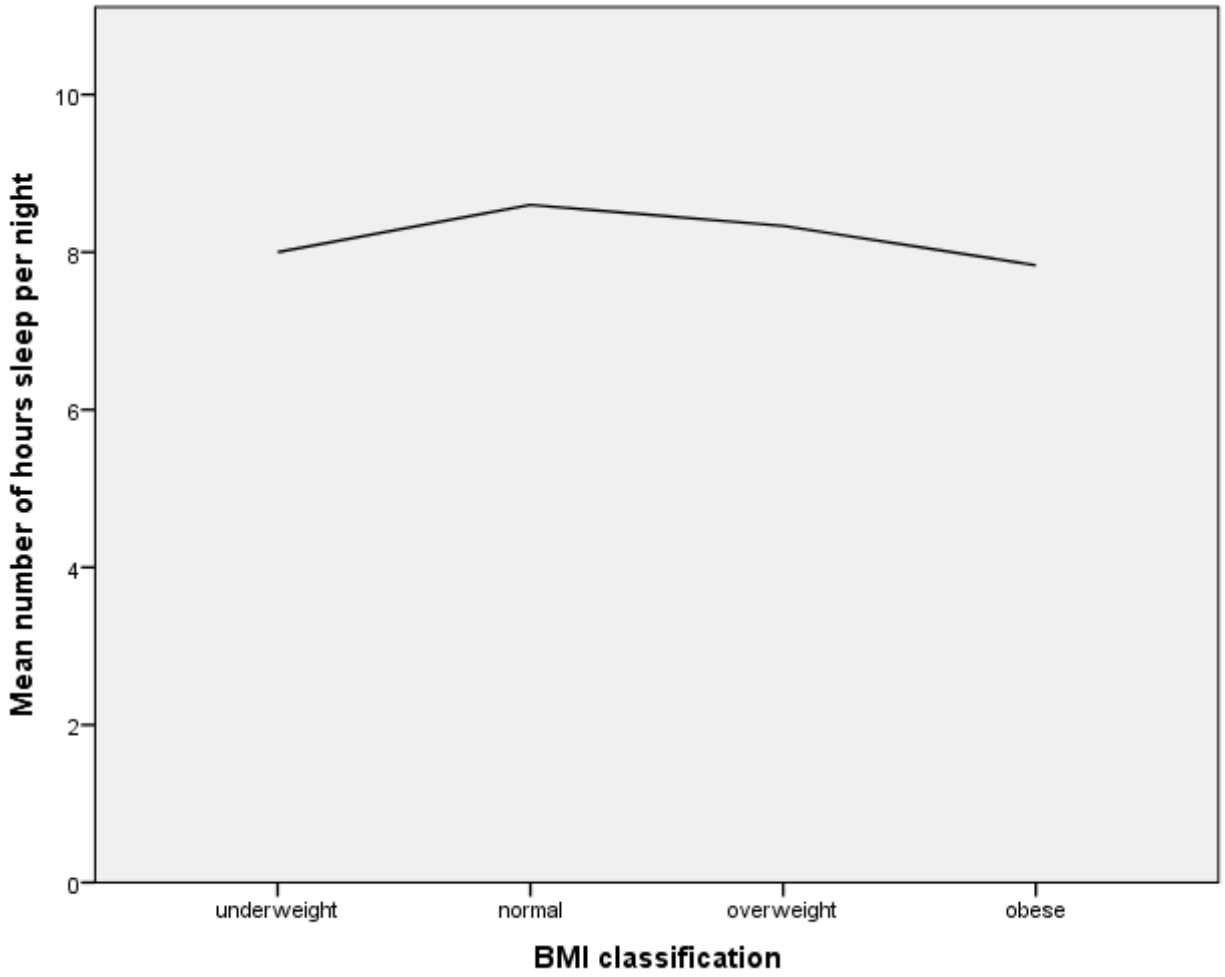


Figure 19. Graph of mean number of hours of sleep per night against BMI classification

APPENDIX 21 – FREC ETHICS APPROVAL

Faculty of Medicine, Dentistry and Clinical Sciences
Research Ethics Committee

frec@chester.ac.uk

03/03/2016

Doreen Micallef
Kent Street
FGR 1555
Malta

Dear Doreen

Study title: Assessment of causes of childhood obesity in 11 year-old Maltese children
FREC reference: **1138/16/DM/CSN**
Version number: ***1***

Thank you for sending your application with amendments to the Faculty of Life Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation.

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	1	Jan 2016
Appendix 1 – List of References	1	Jan 2016
Appendix 2 – Summary CV for Lead Researcher	1	Jan 2016
Appendix 3 – Letter(s) of invitation to participants	1	Jan 2016
Appendix 4 – Participant Information Sheet [PIS]	1	Jan 2016
Appendix 13 – Letters of invitation to participants	1	Jan 2016
Appendix 5 – Participant Consent Form	1	Jan 2016
Appendix 6 – Written permissions from relevant personnel	1	Jan 2016
Appendix 7 – Validated questionnaire	1	Jan 2016
Appendix 8 – Measurement protocols	1	Jan 2016
Appendix 9 – CDC Growth Charts	1	Jan 2016

Appendix 10 – Translated information sheet	1	Jan 2016
Appendix 11 – Translated consent sheet	1	Jan 2016
Appendix 14 – Confirmation of population size	1	Jan 2016
Appendix 12 – Sample size calculation	1	Jan 2016
Appendix 15 – Translated letter if invitation	1	Jan 2016
Appendix 7a – Questionnaire scoring system	1	Jan 2016
Response to FREC request for further information or clarification	1	Jan 2016

Please note that this approval is given in accordance with the requirements of English law only. For research taking place wholly or partly within other jurisdictions (including Wales, Scotland and Northern Ireland), you should seek further advice from the Committee Chair / Secretary or the Research and Knowledge Transfer Office and may need additional approval from the appropriate agencies in the country (or countries) in which the research will take place.

With the Committee's best wishes for the success of this project.

Yours sincerely,

Professor Ben Green
Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of approval.

Cc. Supervisor/FREC Representative

APPENDIX 22 – UNIVERSITY OF MALTA RESEARCH COMMITTEE APPROVAL

Applicant's email: dorsuemicallef@gmail.com Index No:

UNIVERSITY OF MALTA

UNIVERSITY RESEARCH ETHICS COMMITTEE

Check list to be included with UREC Proposal Form

Please make sure to tick **ALL** the items. Incomplete forms will not be accepted

		YES	NOT APP.
1a.	Recruitment letter/ information sheet for subjects, in English	☒	☐
1b.	Recruitment letter/ information sheet for subjects , in Maltese	☒	☐
2a.	Consent form, in English, signed by supervisor, and including your contact details	☒	☐
2b.	Consent form, in Maltese, signed by supervisor and including your contact details	☒	☐
3a.	In the case of children or other vulnerable groups, consent forms for parents/ guardians, in English	☒	☐
3b.	In the case of children or other vulnerable groups, consent forms for parents/ guardians, in Maltese	☒	☐
4a.	Tests, questionnaires, interview or focus group questions, etc in English	☒	☐
4b.	Tests, questionnaires, interview or focus group questions, etc in Maltese	☒	☐
5a.	Other institutional approval for access to subjects: Health Division, Directorate for Quality and Standards in Education, Department of Public Health, Curia…	☒	☐
5d.	Other institutional approval for access of data: Registrar, Data Protection Officer Health Division/ Hospital, Directorate for Quality and Standards in Education, Department of Public Health…	☒	☐
5c.	Approval from Person Directly responsible for subjects: Medical Consultants, Nursing Officers, Head of School	☒	☐

Received by Faculty Office on	
Discussed by Faculty Research Ethics Committee on	
Discussed by University Research Ethics Committee on	

1

UNIVERSITY OF MALTA

Request for Approval of Human Subjects Research

Please type. Handwritten forms will not be accepted.

FROM: (*name, address for correspondence)* Doreen Micallef *58, Kent Str., Fgura FGR 1555*	PROJECT TITLE: Assessment of causes of childhood obesity in year 6 Maltese children
TELEPHONE: 21823406/99457148	
EMAIL: dorsuemicallef@gmail.com	
COURSE AND YEAR: MSc Weight Management, University of Chester 2013 - 2016	
DURATION OF ENTIRE PROJECT: From subject to this approval To 01/09/2016	FACULTY SUPERVISOR'S NAME AND EMAIL: Prof. Stephen Fallows s.fallows@chester.ac.uk

ANTICIPATED FUNDING SOURSE: *(Include grant or contact number if known)* *Not applicable (self funded)*

1. Please give a brief summary of the purpose of the research, in non-technical language. The aim of this study is to investigate the relationship of some known causes of childhood obesity in Maltese children attending year 6 in relation to measures of body mass index (BMI). The study will focus on activity patterns, screen time, soft drinks consumption and sleep patterns.The study aims to consider whether there is a relationship between body mass index and activity patterns, screen time, soft drinks consumption and sleep patterns.
2. Give details of procedures that relate to subjects' participation (a) How are subjects recruited? What inducement is offered? (*Append copy of letter or advertisement or poster, if any.)* *Year 6 boys and girls attending all three different types of primary schools present in Malta (Church, State and Independent schools) will be sampled from randomly selected schools included in a list available from the Education Department. An approximately equal ratio of boys and girls will be included as participants. Children who are wheelchair users will not be recruited for this study as their level of inactivity may bias the outcome of the relationship of activity to BMI.*

(b) Salient characteristics of subjects – number who will participate, age range, sex, institutional affiliation, other special criteria:
From data gathered from the Education Department of Malta, there are currently 4022 ten to eleven year-old children attending year six in all Maltese schools. Using a confidence level of 95% and a confidence interval of 10, the sample size needed is calculated to be 94 individuals. Children (both males and females) attending year 6 during the scholastic year 2015-2016 are eligible to be included in this study. However, children with mobility issues (i.e. children who are wheelchair users) will be excluded from the study as their level of inactivity might bias the outcome of the relationship of activity to BMI.

(c) Describe how permission has been obtained from cooperating institution(s) – school, hospital, organization, prison, or other relevant organization (*append letters).* Is the approval of another Research Ethics Committee required?
The individual schools have been contacted (as per emails appended). Permission from the Education Department and the Curia will be sought once approval from UREC has been received. Approval by the University of Chester FREC has been received (as appended).

(d) What do subjects do, or what is done to them, or what information is gathered? (*Append copies of instructions or tests or questionnaires)* How many times will observations, test, etc., be conducted? How long will their participation take?
Schools which have accepted to participate in this study will be given participant information sheets and participation consent forms (both of which will be given an individual child participant number to maintain the identity of the participant anonymous) to distribute to a number of children attending year 6. The child will then pass these on to the parent/guardian and bring them back to school with them once these are completed within a pre-established deadline. On the day of data collection, the researcher will collect the signed sheets from those children whose parent/guardian has consented their child's participation. The child's height and weight (measured in their school uniform but without shoes) will be recorded (as outlined by the NHANES Anthropometry procedures manual - appended) by the researcher in the presence of a gender appropriate member of staff and a questionnaire (Bervoets et al., 2014; Hardy, Booth, & Okely, 2007; Hedrick, Comber, Estabrooks, Savla, & Davy, 2010; Silva, Silva, Braga, & Neto, 2014) (bearing the individual child participant number already allocated) will be given to the child to fill in. Questionnaires will be filled in during the students' English lesson and will be explained by the researcher and compilation will be aided by the researcher and the English teacher. Children who have not been consented by their parent/guardian to participate in this study will be asked to draw a chart on the theme 'Healthy eating at school and at home'.

(e) Which of the following data categories are collected? Please tick where appropriate.

Data that reveals:

Race and ethnic origin	☐
Political opinions	☐
Religious and philosophical beliefs	☐
Trade union memberships	☐
Health	☒
Sex life	☐
Genetic information	☐

3. How do you explain the research to subjects and obtain their informed consent to participate? *(If in writing, append a copy of consent form.)* If subjects are minors, mentally infirm, or otherwise not legally competent to consent to participation, how is their assent obtained and from whom is proxy consent obtained? How is it made clear to subjects that they can quit the study at any time?
Participation will be on a voluntary basis and will be decided upon by the child's parent/guardian. Parents will be sent a participant information sheet and a consent form ahead of the date of the data gathering session. It has been made clear in both the participant information sheet and the consent form that subjects can quit the study at any time. If parents/guardians should wish to withdraw, then the child will simply need to turn up without a consent form on the day of data collection. Should parents/guardians decide to withdraw after data collection has taken place then they may send an email to the researcher or contact the head of school, stating the individual child participant number. A participant information sheet and consent form for children has also been prepared (appended).

4. Do subjects risk *any* harm – physical/ psychological/ legal/ social – by participating in the research? Are the risks necessary? What safeguards do you take to minimize the risks?
Students will remain anonymous throughout the data collection and processing and in the publication of results. This will be achieved by alloting an individual participant number which will appear on both the consent form and the questionnaire.Students measurements will be taken in the presence of gender appropriate staff.There are no safety issues or health risks involved in the anthropometric measurements to be taken. Measurements are also to be taken in the presence of a member of the school staff and physical contact with the students is to be kept to a minimum and for appropriate reasons (Ikeda, Crawford, & Woodward-Lopez, 2006; Nihiser et al., 2009). There may be a potential risk of bullying of heavier individuals by normal weight peers. This will be avoided since each individual child will be weighed in a separate area/room which is inaccessible to the other children. Weighing will be carried out by the researcher in the presence of a gender appropriate member of the school staff. Please also refer to attached risk assessment form.

5. Are subjects deliberately deceived in *any* way? If so, what is the nature of the deception? Is it likely to be significant to subjects? Is there any other way to conduct the research what would not involve deception, and, if so, why have you not chosen that alternative? What explanation for the deception do you give to subjects following their participation? No deception is involved in this study.
6. How will participation in this research benefit subjects? If subjects will be 'debriefed' or receive information about the research project following its conclusion, how do you ensure the educational value of the process? (*Include copies of any debriefing or educational materials)* Whether the individual is obese or not, the data gathered will help local authorities to establish educational promotional campaigns to educate people in the battle against childhood obesity and hence individuals will learn how to prevent obesity and in cases of obese individuals, to seek advice to address the problem. Educational sessions on childhood obesity and its prevention will be offered to the participating classes as a follow up measure by the researcher. The school nurse will be notified of any students whose BMI is of concern and requires intervention so that the parents/guardians may be duly informed through the proper school channels.

TERMS AND CONDITIONS FOR APPROVAL IN TERMS OF THE DATA PROTECTION ACT

- Personal data shall only be collected and processed for the specific research purpose.
- The data shall be adequate, relevant and not excessive in relation to the processing purpose.
- All reasonable measures shall be taken to ensure the correctness of personal data
- Personal data shall not be disclosed to third parties and may only be required by the University or the Supervisor for verification purposes. All necessary measures shall be implemented to ensure confidentiality and where possible, data shall be anonymized.
- Unless otherwise authorized by the University Research Ethics Committee, the researcher shall obtain the consent from the data subject (respondent) and provide him with the following information: The researcher's identity and habitual residence, the purpose of processing and the recipients to whom personal data may be disclosed. The data subject shall also be informed about his rights to access, rectify, and where applicable erase the data concerning him.

I, the undersigned hereby undertake to abide by the terms and conditions for approval as attached to this application.

I, the undersigned, also give my consent to the University of Malta's Research Ethics Committee to process my personal data for the purpose of evaluating my request and other matters related to this application. I also understand that, I can request in writing a copy of my personal information. I shall also request rectification, blocking or erasure of such personal data that has not been processed in accordance with the Act.

Signature:

APPLICANT'S SIGNATURE:	FACULTY SUPERVISOR'S SIGNATURE
I UNDERSTAND THAT I WILL NOT INITIATE MY RESEARCH PRIOR TO RECEIVING APPROVAL FROM THE UREC.	*I have reviewed this completed application and I am satisfied with the adequacy of the proposed research design and the measures proposed for the protection of human subjects.*
DATE 17/03/16	DATE 17 March 2016

PROF. STEPHEN FALLOWS.
UNIVERSITY OF CHESTER
ENGLAND.

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To be completed by Faculty Research Ethics Committee

We have examined the above proposal and advise

Acceptance **Refusal** **Conditional Acceptance**

For the following reason/s:

Signature: Date:

To be completed by University Research Ethics Committee

We have examined the above proposal and advise

Acceptance **Refusal** **Conditional Acceptance**

For the following reason/s:

Signature: Date: 6/5/2016

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APPENDIX 23 – EDUCATION DEPARTMENT APPROVAL

DIRETTORAT GHAL
KWALITA' U STANDARDS FL-EDUKAZZJONI
FURJANA VLT 2000
MALTA

DIRECTORATE FOR
QUALITY AND STANDARDS IN EDUCATION
FLORIANA VLT 2000
MALTA

Request for Research in State Schools

A. (Please use BLOCK LETTERS)

Surname: MICALLEF Name: DOREEN

I.D. Card Number: 471782(M)

Telephone No: 21 823406 * Mobile No: 9945-7148 *

Address: 58, KENT STREET

Locality: FGURA Post Code: FGR 1555

E-mail Address: doreenmicallef@gmail.com

Faculty: Medicine, Dentistry & Clinical Sciences, University of Chester Course: Weight management Year Ending: 2016

Title of Research: Assessment of causes of childhood obesity in year 6 Maltese children

Aims of research: ☐ Long Essay ☑ Dissertation ☐ Thesis ☐ Publication

Time Frame: Dec 2015 - Sep 2016 Language Used: English

Description of methodology: Questionnaire, weight & height measurements to Year 6 students sample.

School/s where research is to be carried out: St. Benedict College Birzebbuga. Primary

Years / Forms: Year 6 Age range of students: 10-11.

*** Telephone and mobile numbers will only be used in strict confidence and will not be divulged to third parties.**

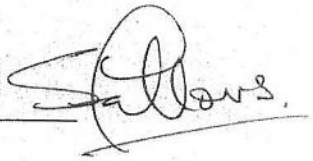
I accept to abide by the rules and regulations re Research in State Schools and to comply with the Data Protection Act 2001.

Warning to applicants - Any false statement, misrepresentation of concealment of material fact on this form or any document presented in support of this application may be grounds for criminal prosecution.

Signature of applicant: Date: 24/03/16

B. Tutor's Approval (where applicable)

The above research work is being carried out under my supervision.

Tutor's Name: PROF STEPHEN FALLOWS Signature: 

Faculty: Faculty of Medicine, Dentistry + Clinical Sciences, University of Chester, England. Faculty Stamp: _____

C. Directorate for Quality and Standards in Education - Official Approval

The above request for permission to carry out research in State Schools is hereby approved according to the official rules and regulations, subject to approval from the University of Malta Ethics Committee.

Raymond Camilleri
Director
Research and Policy Development

Director
(Research and Development Department)

Date: 15 / 04 / 2016

Official Stamp

Conditions for the approval of a request by a student to carry out research work in State Schools

Permission for research in State Schools is subject to the following conditions:

1. The official request form is to be accompanied by a copy of the questionnaire and / or any relevant material intended for use in schools during research work.
2. The original request form, showing the relevant signatures and approval, must be presented to the Head of School.
3. All research work is carried out at the discretion of the relative Head of School and subject to their conditions.
4. Researchers are to observe strict confidentiality at all times.
5. The Directorate for Quality and Standards in Education reserves the right to withdraw permission to carry out research in State Schools at any time and without prior notice.
6. Students are expected to restrict their research to a minimum of students / teachers / administrators / schools, and to avoid any waste of time during their visits to schools.
7. As soon as the research in question is completed, the Directorate for Quality and Standards in Education assumes the right to a full copy (in print/on C.D.) of the research work carried out in State Schools. **Researchers are to forward the copies to the Assistant Director, International Research, Directorate for Quality and Standards in Education.**
8. Researchers are to hand a copy of their Research in print or on C.D. to the relative School/s.
9. In the case of video recordings, researchers have to obtain prior permission from the Head of School and the teacher of the class concerned. Any adults recognisable in the video are to give their explicit consent. Parents of students recognisable in the video are also to be requested to aprove that their siblings may be video-recorded. Two copies of the consent forms are necessary, one copy is to be deposited with the Head of School, and the other copy is to accompany the Request Form for Research in State Schools. Once the video recording is completed, one copy of the videotape is to be forwarded to the Head of School. The Directorate for Quality and Standards in Education reserves the right to request another copy.
10. The video recording's use is to be limited to this sole research and may not be used for other research without the full consent of interested parties including the Directorate for Quality and Standards in Education.

APPENDIX 24 – CURIA APPROVAL

Segretarjat għall-Edukazzjoni
Nisranija
16, Il-Mall, Furjana FRN 1472
Num. ta' Tel. 27790060
Num. Tal-Fax 27790078

Secretariat for Catholic Education,
16, The Mall, Floriana FRN 1472
Tel. No. 27790060
Fax No. 27790078

4th April 2016

Ms Doreen Micallef
58 Kent Street
Fgura FGR 1555

Permission to Carry out Research in Church Schools

Dear Ms Micallef

I would like to inform you that you have been granted permission to carry out your research on the causes of childhood obesity in 11 year old Maltese children as part of your studies leading to the award of a Master Degree in Weight Management, with the University of Chester, UK.

Kindly do not hesitate to contact me should you need further help.

Wishing you the best in your research and your studies.

Kind Regards

Dr Rose Anne Cuschieri
EdD (Sheffield); Med (Sheffield); BA; Cert.Ped
Director for Educational Services in Church Schools
Secretariat for Catholic Education